Electrical World

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Expansion and Improvement Change Investments

ASK any engineer with a utility company that takes pride in its service what he is doing to decrease the unit system investment, and he will almost invariably reply, "Keeping everlastingly on the lookout, as we always have, to see that we get the most for the money spent." There are no radically new ways of saving money. In fact, operating companies are not reducing the unit investment; they are increasing it, because they are going out into new territories, such as rural sections, and are, besides, continually trying to approach uninterrupted service.

Now, expansion of the service area is a public-spirited move and has its salutary effect on public relations, and improving the continuity of service certainly helps in acquiring new industrial loads and holding old ones. But it is time to consider, if the unit investment is climbing too fast, whether the utilities are proceeding too rapidly in either of these directions. Both efforts must continue, but it will be essential to budget the expenditures for these activities more closely.

It appears that the increasing system investments can be met only by rapidly increasing the revenue of existing customers. It is the job of the commercial departments to increase revenues faster than fixed charges are rising, and this is not an easy task when a program of expansion and service improvement is under way. Each property must have a balanced and planned development whereby expenditures and revenues are adjusted to maintain a steady and healthy growth.

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Market Break Did Not Solve Credit Problem

NO ONE knows the immediate cause of last week's drastic selling movement in the markets. One blames Chancellor Snowden of Great Britain, another foreign selling of our securities, another high money rates and the overworked credit situation.

Concerning the combination of factors leading up to the "break" there is a nearer approach to unanimity. In addition to the very great volume of bank credit required to carry an enormous load of securities, the total of new financing has passed all precedent, owing, in large part, to the investment trust movement. Brokers' loans increased last month by about the amount of the new financing, which seems more than coincidence. Naturally, new issues are sold more abundantly in the most receptive market, which is a rising market and a market which in the course of its normal operations requires a maximum of bank credit. Such a combination contains within it the germs of periodic "breaks" like that of last week so long as the present use of bank credit is continued. The problem cannot be solved by a drop in market values or by even a drastic rise in money rates. These are but temporary expedients.

In the utility field the situation is at least mitigated by the use of stock dividends, rights and warrants and by customer sales. Such policies enable corporations to obtain capital continuously rather than overburden a favorable market and thus aggravate the situation. Had the utilities secured all their capital requirements this year by public issue, the credit situation would have been infinitely more critical than it now is.

It is quite conceivable that in the more extensive use of stock dividends and warrants throughout industry there lies an indirect solution of the problem, for which no direct remedy now appears, at least in so far as obtaining junior money is concerned. The raising of senior money does not involve the same problem.

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How to Justify Consolidations

AS EVERY ONE knows, the movement toward consolidation of public utilities throughout the country has been very pronounced during the past year. There is nothing very unusual about this. It is consonant with the general trend in all business toward mass production and large-scale distribution. However, the momentum of the movement, coupled with the unprecedented rise and size of investment trusts, many of which deal in public utility securities, has given rise to misapprehension on the part of legislators and the man in the street. They do not comprehend it, and while not always antagonistic toward consolidations, they have their misgivings none the less. All talk of economies brought about by interconnection and specialized central management is taken with a grain of salt, unless they experience some of the benefits in

a form that they can understand—namely, better service or lower rates.

Now, all consolidations are not capable of being instantly translated into savings in dollars and cents. Many are predicated on futures and some on visions so faint as to be indistinguishable. However, the majority of them have a very real basis for existence; that is, the most economical production of electrical energy. M. S. Sloan, president of the National Electric Light Association, has just been through such a consolidation in New York. When he spoke before the Great Lakes Section on the subject of consolidations and regulation he was on familiar ground. Moreover, he practices what he preaches, for the consolidations in New York were followed by reductions in rates because of economies attending the consolidation. Mr. Sloan is also experienced in public policy and knows its value. It is well, therefore, that he gave timely warning at this juncture. Consolidations should be justified by their works; otherwise the properties embraced in them and the public service commissions which sanctioned them may suffer in repute. Obviously that outcome bodes ill for both.

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The Construction Specialist Often Saves Money

IT IS perfectly in the line of human conduct that if we hire a man to do a job for us, we are very liable to insist that he do a better job than we might do ourselves. For the money we disburse we demand what we consider an adequate return. In work done by ourselves we are inclined to minimize things that would assume much greater importance if we were paying some one else to do it for us. Moreover, the man we hire—if he wants us to hire him again—is anxious to prove that we made no mistake in hiring him the first time. Furthermore, however good we think we are, it is entirely within the limits of possibility that the man we hire, being a specialist, can actually do the job better, more quickly and more cheaply than we can.

It is with organizations, even central-station organizations, as it is with individuals. Charity, beginning at home, makes the organization just a little indulgent in the judgment of its own performance. Excuses are more easily accepted, and there is greater tendency to rationalize errors and mistakes into consonance with intention. In the case of the average operating utility the building of transmission lines and power stations is not a continuous activity. When a line is to be built it is usually necessary to enlarge the part of the organization concerned. There may be required the purchase of construction equipment that may lie idle a long time after the particular job is done. Or possibly the equipment has lain idle for a long time before this job came along. In either case the job must bear the cost of non-use as well as use of equipment. It may not be easy to find exactly the right type of labor, or adequate supervisory talent may not be immediately available. All of these things conspire to swell the cost of construction.

Maybe it would be a good idea to call in XYZ, Incorporated, and let it figure on this job that we are thinking about. Three utility companies at least have found that this is a wise move.

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Clearance of Faults on Alternating-Current Networks

CLEARANCE of faults on alternating-current networks is a problem that engineers anticipated before the adoption of this substitute for the Edison three-wire direct-current system, and tests have been made, although they have had little publicity, which apparently have relieved any misgivings concerning phase-to-phase or phase-to-ground short circuits where the insulation has broken down.

Only recently, however, have quantitative results been obtained with solid copper-to-copper shorts. The records, which no doubt will be released shortly, apply to cables ranging from No. 6 to 500,000 circ.mil, backed by 3,000-kw. transformer capacity and sufficient generating capacity to deliver 100,000 amp. The tests indicated that 1,000,000-circ.mil cable can be fused clear in 20 and 400 seconds with 25,000 and 15,000 amp. respectively, and that 40,000-circ.mil cable can be cleared with the same currents in 0.4 second and 2.5 seconds respectively. Consequently, it appears that the maximum size of cable which can clear itself is largely dependent on the amount of power which can be fed into the fault and how much smoke and flame can be practically liberated.

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A Step Toward Solving the Small-Contractor Problem

MORE and more the electrical industry is coming to appreciate the vital importance of the man who installs the small wiring job. He has for years been the humble member of the family. He has not prospered. Therefore he has struggled and skimped and competed with his fellows on the basis of cheapness. For a long time the rest of the industry has looked down on him for that. Now comes the realization that power companies, manufacturers and wholesalers are all alike dependent upon this man for the size of their market. For in the majority of installations he determines how much material shall be installed, how much equipment shall be connected and how much energy shall be consumed, since inadequacy and inconvenience naturally restrict use.

So there is growing recognition of the need to find a practical cure for the troubles of the small contractor. He himself begins to see that things cannot go on as they have gone so long, because the growth of the

industry from now on will depend largely upon the size of installations and the adequacy of service. Rewiring will loom larger in the market. And all this calls for higher standards both in the selling and the installing of wiring jobs. It will call for a higher type of business man in this branch of the industry.

It is not without significance, therefore, that at the annual convention of the Association of Electragists International last week in Swampscott, Mass., the James H. McGraw medal and purse should have been awarded to John H. Kuhlemeyer for the most outstanding contribution of the year to the advancement of the contractor-dealer branch of the industry. For Kuhlemeyer has become the working apostle of this idea. There is no profit, he believes, in clamoring for "the elimination of the undesirable contractor." There is no benefit in asking for relief from legislation, subsidy or other forms of succor. What is needed is reform, and that can only come when the individual improves his methods and better competitive conditions are established in the communities. Mr. Kuhlemeyer has had the courage not alone to preach this doctrine but to go to city after city and by personal counsel and demonstration set the small contractor in the pathway of progress by getting the local men to adopt sound methods in estimating, cost keeping and the conduct of their financial affairs.

The work has met with gratifying success in many cities, financed by the contractors themselves. It is helping greatly to crystallize the interest of the entire industry—the hope and confidence that something can indeed be done to put the small contractor firmly on his economic feet.

Making Progress in the Isolation of Faults

THE demand for circuit-interrupting devices which will isolate faults before they lead to instability of system operation is bearing fruit. At least two manufacturers have developed oil circuit breakers, not yet in the commercial stage, which will rupture currents in a fraction of the time formerly required. In one case five times the speed of separation of contacts has been obtained with an auxiliary accelerating spring. In another case what is reported to be a radically new method of interrupting an arc with a very short separation of contacts has been employed, but the details have not been disclosed.

With the first method, which is more fully discussed on page 734, a 1,200-amp. arc on a 220-kv. line-to-ground short was interrupted with a "closed-open" duty cycle in eight cycles and a 2,200-amp. arc with an "open-closed-open" duty cycle in five cycles. It is reported that the other development will rupture an 88-kv. arc in four or five inches.

As these and other developments become commercially available, and with the parts that may be added to or substituted for components of old circuit breakers to increase their rupturing capacity, operating engineers will have additional tools with which to solve some of their perplexing problems.

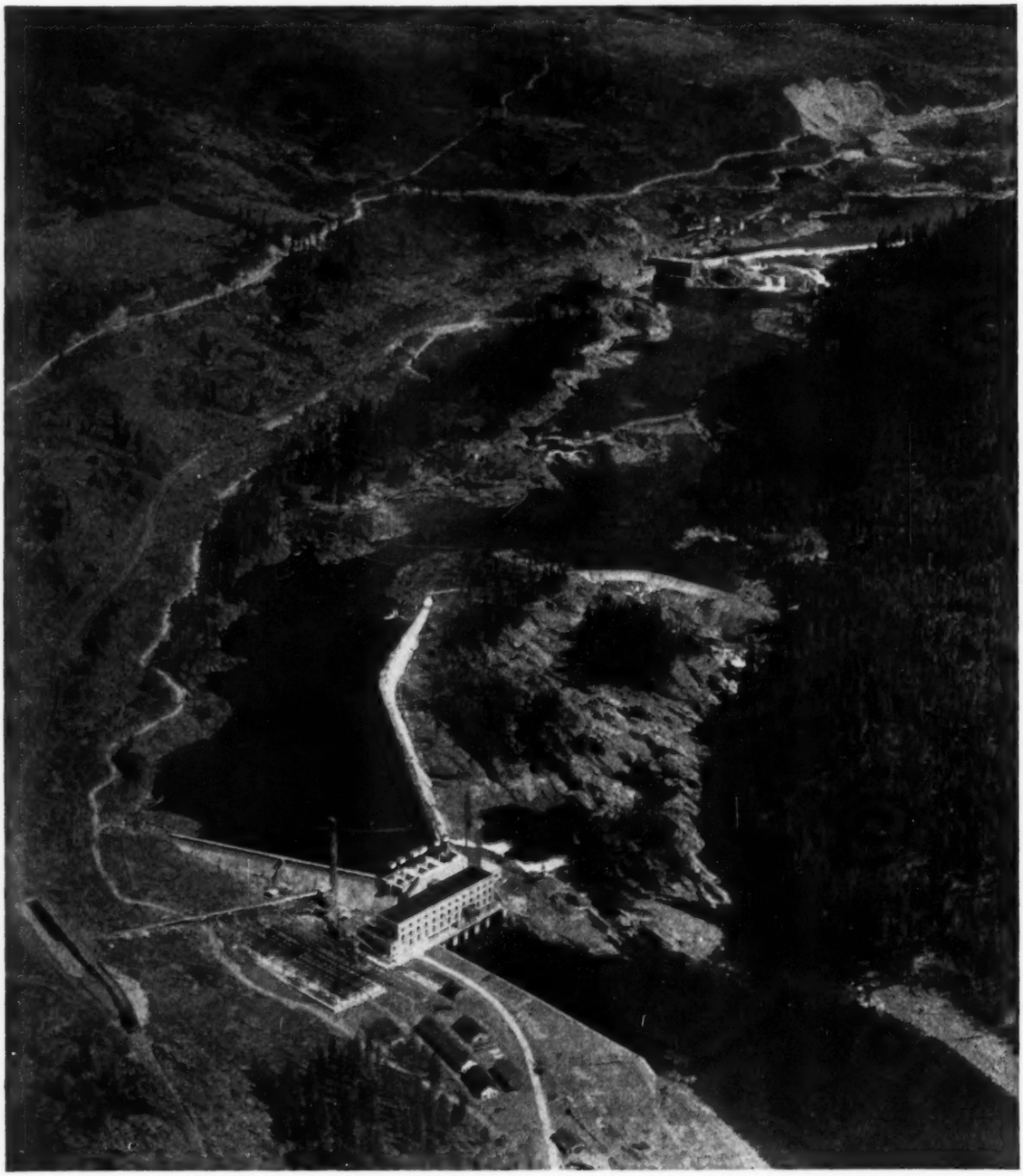
Interconnection Cuts Costs in New England Drought

LOW rainfall during the past summer gave interconnection a real opportunity to demonstrate its value in New England. A thorough study of regional power resources as spring ended showed that the larger systems might expect to handle their summer loads independently of one another if major units of generation were maintained in service condition, and that a certain amount of capacity, including in one case a 45,000-kw. and in another a 35,000-kw. unit in tidewater steam plants, might be withdrawn for some weeks for overhauling without jeopardizing customers' interests. This could have been done without the use of intercompany ties to any material extent, but as the drought increased in severity the cost of operation would have mounted far above normal and no one would have been the gainer by the maintenance of the *status quo*.

Actually, the existence of tie-line facilities and their competent utilization enabled the operating companies, working with others in eastern New York, to minimize the use of their less efficient stations. Some of these had to be made hot and run for varying periods of heavy load during low water, but interconnection permitted load transferring to a degree which, conservatively speaking, saved these companies far more than $1,000 a day as compared with the cost of running exclusively "on their own."

The presence of closely controlled storage facilities in some of the more remote hill country contributed materially to the operating economy of the regional set-up. Water was utilized with the maximum saving to the network system constantly kept in mind as the objective in exchange group practice. Some of the steam generating units involved had not been run for several years, and the added insurance of interconnection, like the moral effect of the British "fleet in being" during the World War, stabilized the power situation in the Northeast to no small degree. Where industries were materially dependent upon the utilization of so-called mechanical water power at plant site, there were in some cases curtailments which gave fresh emphasis to the value of interconnection. The further extension of purchased electrical power to industries received a strong impetus, and while the cost of the drought will unquestionably be reflected in the expense sheets of many plants when the year's operations are scrutinized acutely, the skillful handling of the situation which interconnection facilitated adds another page to the excellent record of the operating engineer in this section of the country.

Kootenay Development Adds 75,000 Hp.



SERVING the Rossland mining district of British Columbia are three hydro-electric plants on the Kootenay River built by the West Kootenay Power & Light Company. The latest of these plants, containing three 25,000-hp. turbines, is shown in the foreground. One of the other plants on this same river is visible at the upper right.

New York Will Buy

Utility Power for New Subways

Exhaustive study shows power cost from 200,000-kw. municipal plant would exceed bid of Edison Company

THE ratification by the Board of Estimate and Apportionment of the city of New York of the contract negotiated by the Board of Transportation with the New York Edison Company for supply of power to operate the city-built subways in progress puts the touch of finality to the largest power contract ever entered into. It represents a load that will amount to practically 210,000 kw. and 800,000,000 kw.-hr. annually by 1940 and a total contract payment by the city in the ten years of almost $40,000,000.

Power for the subways planned was one of the early concerns of the Board of Transportation in shaping its program of subway building up to 1940. On April 26, 1927, the firm of Stevens & Wood, Inc., New York City, was commissioned as consulting engineer (1) to estimate the cost of a new city-owned electrical power plant and the cost of power to be turned out by it; (2) to analyze all proposals made by power or transit companies to furnish power from their systems; (3) to digest all alternatives and make recommendation as to the appropriate commitment on the part of the city administration.

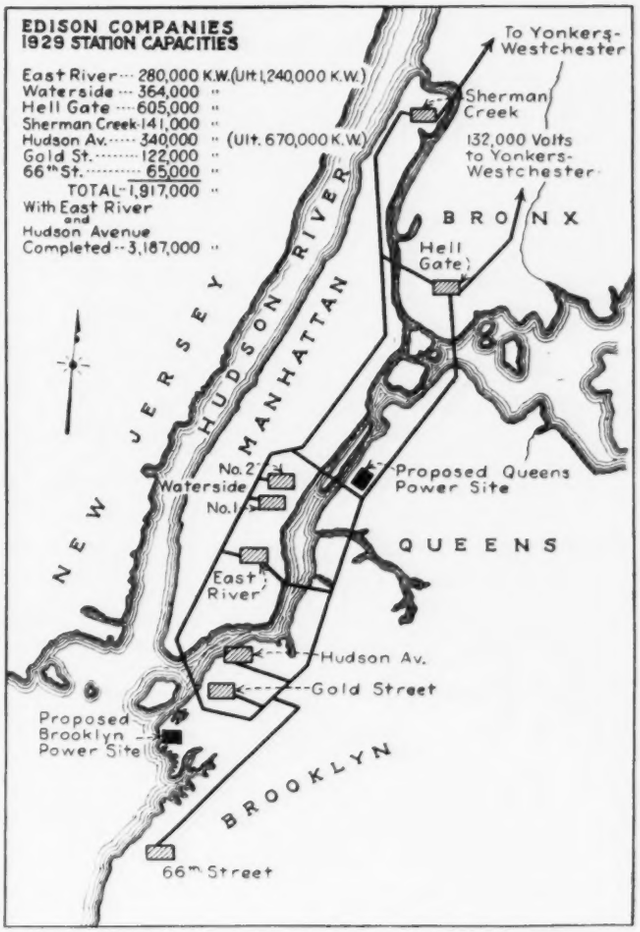
Several fundamental assumptions had to be made to keep the number of these alternatives within limits. The first was as to the point of delivery of the power in computing and analyzing costs, and here it was determined to estimate in terms of three-phase power delivered at cable potheads at incoming buses of the various strategically located city-owned substations (24 ultimately).

The Passing of 25 Cycles

Second, the frequency, 25 or 60 cycles? All early negotiations considered only the use of 25 cycles, which thus far has predominated in heavy electric traction service in America. The consulting engineers found that the consensus of opinion among electrical engineers was that the future would be committed to 60 cycles and that in ten years there would be little 25-cycle equipment on the market. The manufacturers stood as ready to guarantee the performance of 60-cycle equipment as 25 cycle for subway power. Price of purchased power would also be less at 60 cycles. The Edison proposition was therefore set up only on the 60-cycle basis.

The third assumption was as to size of station and of individual turbo-alternator units. To meet a load growing from 18,000 kw. in 1931 to 210,000 kw. in 1940, it was deemed wisest to assume a station in which three 35,000-kw. units would be installed at the outset, growing in five stages to eight 35,000-kw. units by 1940. Eight units would permit one for reserve and one idle on the line to replace any one of the six carrying the peak, in case of failure. Provision for coal storage was made only to the extent of the seven-day supply in the inside bunkers. The estimated cost of the ultimate station (280,000 kw.) is shown in an accompanying table. The cost at the termination of the first stage of development (three 35,000-kw. units) was reported as $18,294,000. This is one-half the ultimate figure and, in conjunction with the small loads of the early years, accounts for the high cost, at the start, of power from the municipally owned station.

With the station set up in preliminary engineering design and the probable cost established, the next move was to estimate the over-all cost of power delivered to the alternating-current substation buses. Due to the pro-



Complete Interconnection of 3,000,000 Kw. Insures Continuity of Service

Estimate of Cost—City-Owned Steam-Electric Station

(280,000 Kw. Capacity)

Summary:	Total Dollars	Dollars per Kilowatt
Preparation of site	48,000	0.17
Yard work	550,000	1.96
Foundations	2,268,000	8.10
Buildings	3,494,000	12.49
Boiler room equipment	9,280,000	33.14
Turbine room equipment	6,560,000	23.43
Electrical equipment	3,580,000	12.78
Service equipment	1,235,000	4.41
Step-up substation	0	0
Preliminary operation	140,000	0.50
Net material and labor	27,155,000	96.98
Omissions and contingencies, 5 per cent	1,358,000	4.85
Gross material and labor	28,513,000	101.83
Engineering, 5 per cent	1,426,000	5.10
Field supervision, 2 per cent	570,000	2.03
Cost without fee	30,509,000	108.96
Fee or equivalent, 5 per cent	1,526,000	5.45
Total construction cost	32,035,000	114.41
Land	1,800,000	6.43
Cost with land	33,835,000	120.84
Interest during construction, 4½ per cent	1,439,000	5.14
Cost to New York City	$35,274,000	$125.98

gressive changes in the peak load, the kilowatt-hour consumption and the installed station capacity, there is noted a wide variation in load factor, for one thing, and in fixed charges allocated to the energy output for another. It is rather striking that a judiciously established plant would have in the first year a cost per kilowatt-hour of 3.6 cents for a block of about 60,000,000 kw.-hr., whereas the Edison company's rate for much smaller blocks of power (such as might be required for subway construction service) was only 1.7 cents per kilowatt-hour. Toward the end of the ten-year estimate the former drops, however, to 0.764 cent, with an average of 0.914 cent per kilowatt-hour.

The Interborough Rapid Transit Company's plant at 59th Street presented the physical possibility of enlargement and rehabilitation to make available five 60,000-kw. turbo-alternators for the city-owned subways, the existing capacity continuing in its allocation to the Interborough-owned routes. This offered a chance of intimate interconnection of two supplies, a resulting high load factor and a billing proportional to the total station output costs, favored as they would be by the load factor. The resulting costs of power obtained from this source ranged from 2.23 to 0.73, with an average of 0.84 cent per kilowatt-hour for the ten years.

During these negotiations the New York Edison Company made a proposal of a rate which would have amounted to the equivalent of 0.95 cent per kilowatt-hour.

Comparative Power Costs

Year	Annual Kilowatt-Hours	New York Edison Bid	Estimated Cost City Plant	Estimated Cost I.R.T. Proposal
1931	64,405,000	$514,595	$2,254,570	$1,395,360
1932	105,730,000	844,782	2,286,568	1,505,520
1933	216,580,000	1,730,474	2,553,494	2,141,640
1934	414,430,000	3,311,295	3,480,049	3,628,800
1935	555,260,000	4,436,527	4,914,937	4,668,840
Total five years	1,356,405,000	$10,837,673	$15,489,618	$13,340,160
1936	617,730,000	$4,935,662	$5,152,396	$4,979,880
1937	673,360,000	5,380,146	5,672,082	5,297,400
1938	714,210,000	5,706,537	5,897,688	5,731,560
1939	759,150,000	6,065,608	6,271,144	5,908,680
1940	789,700,000	6,309,703	6,385,137	6,095,520
Total five years	3,554,150,000	$28,397,656	$29,378,447	$28,013,040
Grand total, ten years	4,910,555,000	$39,235,329	$44,868,065	$41,353,200

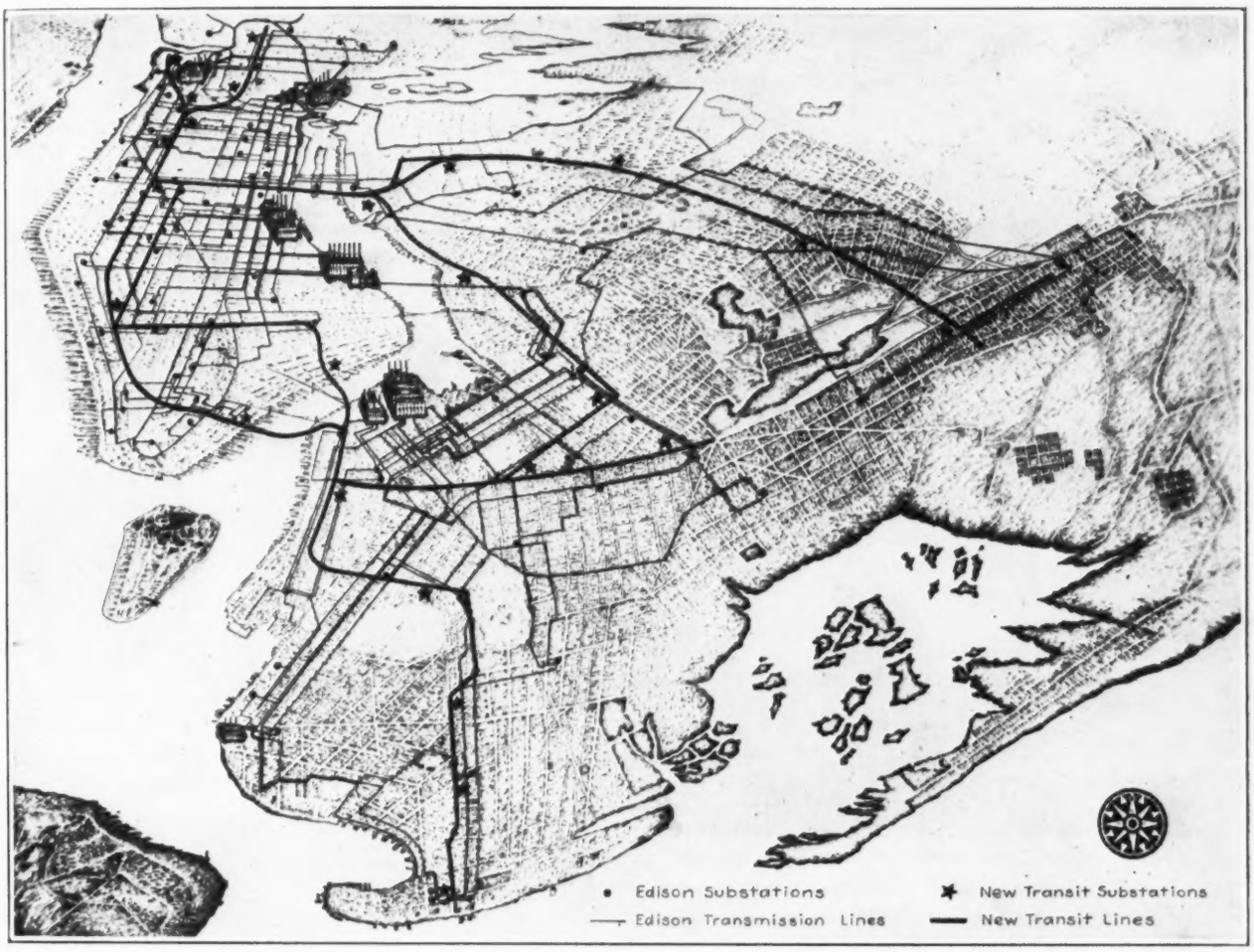
Estimate of Kilowatt-Hour Costs—City-Owned Station

	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939
Kilowatt-hour output from station	58,546,000	75,948,000	145,900,000	301,800,000	529,000,000	592,000,000	653,800,000	705,000,000	748,840,000	782,000,000
Kilowatt-hours delivered to substation	57,965,000	75,200,000	144,430,000	298,780,000	524,030,000	585,980,000	647,250,000	698,550,000	741,120,000	774,330,000
Average yearly load kilowatts at substation	6,617	8,585	16,487	34,107	59,821	66,892	73,887	79,743	84,603	88,394
Maximum hourly load kilowatts at substation	18,109	33,910	71,959	131,299	148,207	164,300	179,925	192,467	202,544	209,907
Load factor, 4 per cent	36.5	25.3	22.9	26.0	40.4	40.7	41.0	41.4	41.5	42.1
Thermal consumption B.t.u. per kilowatt-hour	29,940	24,540	20,360	17,460	16,390	16,190	16,180	16,080	16,000	16,000
Plant capacity, all 35,000-kw. units										
Number of machines needed in maximum hour	1— 35,000	1— 35,000	2— 35,000	4— 35,000	4— 35,000	5— 35,000	5— 35,000	6— 35,000	6— 35,000	6— 35,000
Number of machines running in maximum hour	2— 35,000	2— 35,000	3— 35,000	5— 35,000	5— 35,000	6— 35,000	6— 35,000	7— 35,000	7— 35,000	7— 35,000
Number of machines installed	3— 35,000	3— 35,000	4— 35,000	6— 35,000	6— 35,000	7— 35,000	7— 35,000	8— 35,000	8— 35,000	8— 35,000
Investment in plant	$18,894,000	18,894,000	21,994,000	29,334,000	29,334,000	32,424,000	32,424,000	35,274,000	35,274,000	35,274,000
Investment in cables and ducts	$890,460	1,009,000	1,338,900	2,969,200	3,520,000	3,707,000	4,016,700	4,493,200	4,509,700	4,509,700
Total investment	$19,784,460	19,903,000	23,332,900	32,303,200	32,854,000	36,131,000	36,440,700	39,767,200	39,783,700	39,783,700
Operating Cost										
Coal at $5 per long ton	$279,510	297,160	471,910	840,360	1,382,330	1,527,770	1,686,390	1,808,000	1,910,300	1,995,080
Water	$4,008	5,009	6,308	7,609	8,909	10,208	11,508	12,809	14,803	14,950
Operating labor	$185,500	185,500	187,889	224,165	334,072	338,002	381,231	382,370	394,896	394,896
Supervision	$54,240	54,240	54,240	55,125	64,860	64,860	64,860	64,860	64,860	64,860
Lubricants, supplies and expense	$36,000	36,000	37,500	57,000	90,000	91,500	108,000	109,500	126,000	126,000
Maintenance, material and labor	$105,000	106,666	129,167	184,412	290,810	325,163	359,083	387,760	411,555	432,080
Total plant operating cost	$664,258	684,575	887,014	1,368,671	2,170,981	2,357,503	2,611,072	2,765,299	2,922,414	3,027,866
Cost per kilowatt-hour (station operating cost) mills per kilowatt-hour	11.35	9.01	6.08	4.53	4.10	3.99	3.99	3.92	3.90	3.87
Cost of duct and cable maintenance	$4,810	5,606	7,972	19,456	23,331	24,649	26,843	30,195	30,316	30,316
Total operating or plant cost	$669,068	690,181	894,986	1,388,127	2,194,312	2,382,152	2,637,915	2,795,494	2,952,730	3,058,182
Fixed Charges										
Interest on power station, 4.25 per cent	$802,994	802,994	813,974	960,741	1,246,695	1,257,639	1,378,020	1,388,114	1,449,145	1,499,145
Amortization on power station, 0.66 per cent	$124,700	124,700	126,406	149,197	193,604	195,303	213,998	215,566	232,808	232,808
Depreciation on power station, 2.25 per cent	$425,115	425,115	430,928	508,627	660,015	665,809	729,540	734,884	793,665	793,665
Total power station fixed charges	$1,352,809	1,352,809	1,371,308	1,618,565	2,100,314	2,118,751	2,321,558	2,338,564	2,525,618	2,525,618
Fixed charges on cables and ducts, 7.16 per cent	$63,757	72,244	95,865	212,595	252,032	265,421	287,596	321,713	322,895	322,895
Total fixed charges	$1,416,566	1,425,053	1,467,173	1,831,160	2,352,346	2,384,172	2,609,154	2,660,277	2,848,513	2,848,513
Total annual cost of power at alternating-current substation bus	$2,085,634	2,115,234	2,362,159	3,219,287	4,546,658	4,766,324	5,247,069	5,455,771	5,801,243	5,906,695
Cost per kilowatt-hour (alternating-current substation bus) mills per kilowatt-hour	36.00	28.10	16.32	10.80	8.68	8.14	8.10	7.82	7.82	7.64

In detail the price was 1 cent per kilowatt-hour at 40 per cent load factor, with adjustment of 0.005 cent for each 0.4 per cent change in load factor.

Subsequently, the several Edison companies in Greater New York consolidated and the new president, M. S. Sloan, indicated a willingness to sell the city the subway power at actual cost of production plus a reasonable rate of return on the generating and transmitting facilities herewith. Another factor to which the consulting engineers called attention was that the Edison figure was a bid contractual price, whereas the city plant and I.R.T. figures were merely engineering estimates on the basis of present-day costs, subject to the hazards of future price changes for coal, labor and capital.

The Edison proposal, as noted in the issue of July 20, permits the city at any time to cancel the contract, affecting any or all points of delivery, without incurring any obligation in respect to the amortization investment of the power company in power plant or generating equipment or cables. The power company, subsequent to notice of cancellation, is obligated to continue service until such time as the city has actually available an adequate supply of power from some other source.



New Subway System Closely Parallels Existing Feeder System

devoted to the subway load. The consequence was the bid, approved by the Board of Transportation on July 9, 1929, of $1.33 per kilowatt of maximum monthly demand plus 0.4 cent per kilowatt-hour used. Ignoring the adjustments for variation in coal cost and B.t.u. content, the average cost to the city over the ten-year period will be 0.805 cent per kilowatt-hour. If the city regularly pays its monthly bills within 45 days the ¾ per cent prompt payment discount will bring the average to 0.799 cent per kilowatt-hour. The consulting engineers point out to the city authorities that the property tax alone on the New York Edison Company's additional plant and distribution facilities will amount to a sizable item. In effect, it would reduce the net energy cost to the city to a figure of about 0.7 cent, considerably lower than the estimated average cost from a city-owned plant. This is a factor not given as much weight as it is entitled to in an analysis of comparative costs of municipal plants as against purchased power. Even omitting this credit of tax payments, the saving to the city is more than $5,000,000 in the ten-year period, as reflected by the table

Sell Your Product

By C. S. Ruffner

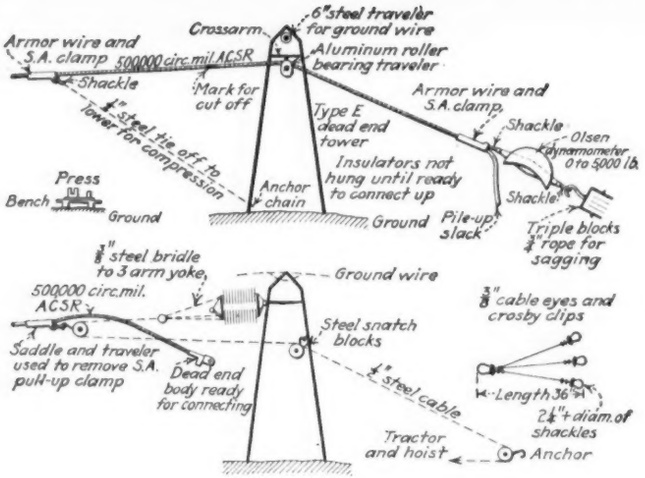
President Empire State Gas and Electric Association.

WE ARE good engineers but poor salesmen. We know how to make our products but not how to sell them. We must recognize that we are not in the business of merchandising appliances, but are primarily in the business of selling gas and electricity.

Erection of Strain Insulators Simplified

By J. Elmer Housley
Alcoa, Tenn.

ONE OF the difficult jobs in transmission line construction is the erection of heavy dead-end or strain insulators, particularly the triple string type for high voltages. A 154,000-volt line built a short time ago in the South used 36 insulators in each dead-end assembly with triple yoke hardware and twelve units per string.



Line Construction Simplified by Improved Cable Bridle

A comparatively simple yet effective device was used for the erection of the insulator assembly. As illustrated, the device consists of a triple cable bridle arranged so as to draw the line cable up to position and at the same time hold the insulator assembly in its natural nearly horizontal position in order to permit the union of the cable and the insulator assembly.

The cable bridle for handling 500,000-circ.mil steel-reinforced aluminum cable was made from four 2¼-in. diameter shackles and three pieces of ⅜-in. steel cable with the necessary Crosby clips and cable thimbles. The length over all was 36 in. One shackle was applied to one end common to the three cables and the free end of each cable had a shackle.

The bridle was connected to the insulator triple yoke at the three corners with the three shackles and a ½-in. hoist line was attached to the common shackle. The line was threaded into a sheave attached to a "come-along," made from a semi-anchor clamp, and was looped back through a snatch block on the tower, thence to the hoist.

The method used to mark the cable for the application of the steel dead-end body and the aluminum terminal body (which is compressed over the steel body after the latter was applied with a 100-ton portable press) is shown in the sketch. A semi-anchor clamp is applied to the cable and the cable is sagged while threaded through travelers, which are special large diameter aluminum sheave wheel snatch blocks equipped with wood beckets and roller bearings. A steel tie-off permits lowering the cable after the location of the dead end is marked off, using a stick of proper length from the cross-arm to a point on the cable. After the fittings are applied to the cable the insulator assembly is hung in place and the bridle rig is hooked up and the cable may be drawn up. Insertion of a single pin completes the job.

The advantage of this method is its simplicity, availability of necessary parts, light weight and a minimum amount of rigging on the tower.

Causes of Accidents During Line Construction

THE following excerpt from the book "Policies and Regulations," published for members of its organization by the Hoosier Engineering Company, is a succinct statement of the commoner causes of accidents in overhead line construction and for that reason is quoted here:

> The business of Hoosier Engineering Company is not inherently dangerous. It becomes dangerous only when there is a failure on the part of the employees to exercise a reasonable degree of care.
>
> The responsibility for all injuries to person and damage to property is placed on the crew foreman in charge of the unit involved. It is incumbent, therefore, on all foremen to see to it that all work is done in a safe manner, and when any doubt arises, the superintendent or general foreman should be consulted.
>
> Practically all of the serious accidents to company employees have been traceable to a disregard of its positive rules and regulations and a failure to exercise due care. Particular attention is directed to the following instances which are quite ordinary operations but may be the cause of serious accidents if proper care is not exercised:
>
> 1. Failure to place a temporary guy rope on steel being raised into position, especially in locations where there is a possibility of such steel swinging into live high-tension wires.
> 2. The continued use of a team for wire stringing. The team may become frightened at a critical moment and pull the conductor into live wires, etc.
> 3. Failure to guy temporary dead-end poles properly.
> 4. Failure to watch clearance and place protective grounds when working on or near high-tension lines.
> 5. Handling of poles while unloading from railroad cars.
> 6. Failure to observe rules relative to the care and handling of dynamite.

Effect of Choke Coils

Very high inductance needed for choke coils to decrease the voltage or steepness of traveling waves. Mathematical analysis shows doubtful value of coils for arresters or lines

By S. MURRAY JONES and R. A. HUDSON
Southeastern Engineering Company, Birmingham, Ala.

FOR many years it has been a more or less standard practice among electric power companies to install choke coils in transmission and distribution lines at any points where it was desired to exclude or diminish the effect of lightning and other traveling waves arriving on the incoming lines. Choke coils have been most commonly used in conjunction with lightning arresters as a means of protecting substation apparatus, although they have frequently been used alone at the lower voltages. When used with lightning arresters the choke coils have been installed in the overhead power circuit between the arrester and the apparatus to be protected.

The generally accepted theory of a choke coil is: (1) That it delays, or holds back, the incoming voltage wave until the arrester has had sufficient time to discharge the overvoltage to earth; (2) that the piling up of voltage on the arrester side of the choke coil incidental to this retardation of the wave causes the arrester to discharge more rapidly, and (3) that it decreases the steepness of the front of the wave to a degree which prevents a serious rise of voltage at the protected apparatus. There is, also, a popular belief that a choke coil alone materially decreases the voltage arriving at the apparatus below that of the original surge.

In recent years considerable discussion has occurred relative to the true protective value of choke coils, and there is a growing conviction among operating engineers, who have had the opportunity to observe their performance under actual conditions, that the effect of choke coils, of the common design, on traveling waves is entirely negligible. More than this, it is felt that choke coils may often give rise to high-frequency oscillations which may be dangerous to transformers and generators. Fortunately, this problem may now be mathematically and experimentally analyzed by means of the Heaviside operation method of calculation and the cathode-ray oscillograph and should soon be completely clarified.

In this article the mathematical treatment of choke coils under various assumed conditions is presented. Specifically, traveling waves with wave fronts of one microsecond and seven microseconds duration are considered, the former value representing probably the steepest waves ever encountered in practice and latter value representing what is now considered as an approximately average steepness of wave front. In all of the calculations the inductance of the choke coils is taken as 36.5 microhenries, which is about the maximum value for typical coils, and the surge impedance of the connected line is assumed equal to 400 ohms. The first calculations neglect the effect of the distributed capacitance of the coil, but later this effect is introduced and shown to be negligible.

The results of this study indicate that a choke coil alone cannot appreciably decrease the voltage or the steepness of the front of the wave transmitted through the coil unless the inductance is increased to many times the usual values. For example, in order to decrease the voltage of the transmitted wave to two-thirds that of

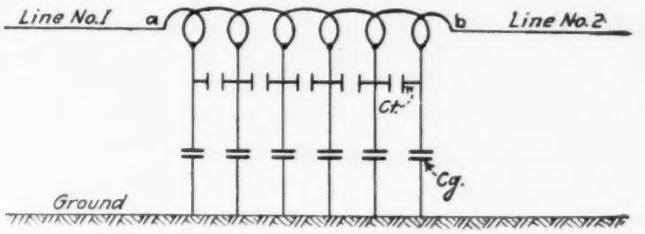


Fig. 1—Schematic Representation of a Choke Coil

an incoming seven-microsecond front wave an inductance of 8,000 microhenries would be required. When used in conjunction with a lightning arrester it is shown that with a one-microsecond front wave a delay of only 0.15 microsecond is affected in the front of the transmitted wave, the peak voltage being the same with the coil as without it. This retardation of 0.15 microsecond, although for practical purposes negligible, is a theoretical argument in favor of choke coils. However, as shown by K. B. McEachron,[1] the effectiveness of a lightning arrester is greatly dependent upon its ability to "cut off" the voltage wave reflected from the apparatus, and since the choke coil is located between the apparatus and the arrester it hinders the lightning arrester in this respect. Thus, the slight benefit derived at first is practically completely offset.

In addition to hindering the discharging by the lightning arrester of the reflected wave, the choke coil is apt to cause successive reflections back and forth between it and the protected apparatus, which may give rise to dangerous voltages; that is, the wave reflected by the apparatus, upon striking the choke coil, would be partially reflected, and this reflected wave would add

[1] *"Protection of Station Equipment on High-Voltage Transmission Lines," "General Electric Review," May, 1928.*

to the voltage already existing. When this partial reflection reached the apparatus a further increase would occur, and so on until the trapped wave was completely dissipated. This effect, of course, would be of very small magnitude, but it constitutes a disadvantage of choke coils which offsets the likewise very small advantage to be gained from a retardation of 0.15 microsecond in the wave front.

It would seem, therefore, that choke coils constitute

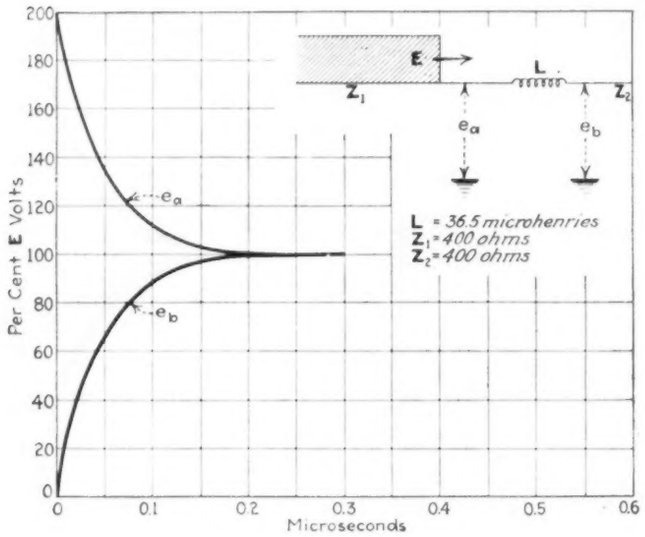


Fig. 2—Effect of a Choke Coil on a Perpendicular Wave

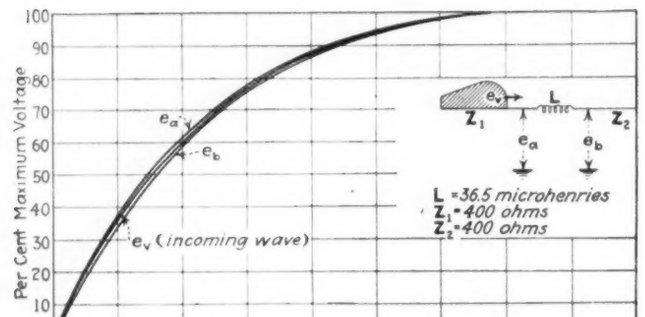


Fig. 3—Effect of Lumped Inductance Type of Choke Coil on Lightning Wave

an unnecessary expenditure of money and very likely an unnecessary evil.[2] Instead of installing choke coils in an attempt to compensate for the distance between the apparatus and the arrester, and thereby causing a false sense of security, it would probably be best to eliminate them entirely and concentrate on locating arresters as near the apparatus as possible.

Method of Calculation

The theory of traveling waves in transmission lines cannot be directly applied to choke coils because a coil, unlike a transmission line, possesses capacitance and mutual inductance between turns. Assuming the inductance and capacitance to be uniformly distributed along the winding, a choke coil may be represented schematically by Fig. 1, if it is remembered that mutual inductance exists between turns. An absolutely exact treatment of the choke coil would be too involved, if not impossible, to calculate. For example, if a perpendicular electrical wave should travel along line (1), Fig. 1, striking the coil at (*a*), the initial performance of the coil would be determined almost entirely by the capacitances C_t and C_g, where C_t represents capacitance between turns and C_g the capitance of each turn to ground. After the first instant, current would flow in the inductance, a readjustment of energy would take place and oscillations of an exceedingly complex nature would result. To avoid this difficulty, a pure lumped inductance will be first considered. Later the effect of capacitance will be taken into account.

It is assumed for the present that lines (1) and (2) in Fig. 1 are so long that reflections at their distant ends need not be considered. This is done to observe the effect of the choke coil alone. Let the surge impedances of lines (1) and (2) be respectively:

$$Z_1 = \sqrt{\frac{l_1}{c_1}}$$

$$Z_2 = \sqrt{\frac{l_2}{c_2}}$$

where resistance and leakance are neglected and l and c are respectively inductance and capacitance per unit length. Let $N(p)$ be the impedance operator of the choke coil network. By the well-established formulas for the reflection of a surge at a junction or terminal

$$e_r = \frac{[N(p) + Z_2] - Z_1}{N(p) + Z_2 + Z_1} e_v \qquad (1)$$

$$e_a = \frac{2[N(p) + Z_2]}{N(p) + Z_2 + Z_1} e_v \qquad (2)$$

where e_v is the voltage of the arriving surge; e_r is the voltage of the reflected surge and e_a and e_b are respectively the resultant voltages at points (*a*) and (*b*), Fig. 1. The operator which connects voltages e_a and e_b is:

$$e_b = \frac{Z_2}{N(p) + Z_2} e_a \qquad (3)$$

$$e_b = \frac{2Z_2}{N(p) + Z_2 + Z_1} e_v \qquad (4)$$

In the present case:

$$N(p) = L(p)$$

where L is the inductance of the choke coil.

Case of Perpendicular Wave:

If e_v is a perpendicular wave of voltage E, then:

$$e_a = \left[\frac{2Z_2}{Z_1 + Z_2} + \frac{2Z_1}{Z_1 + Z_2}\epsilon - \frac{Z_1 + Z_2}{L}t\right]El \qquad (5)$$

$$e_b = \frac{2Z_2}{Z_1 + Z_2}\left[1 - \epsilon - \frac{Z_1 + Z_2}{L}t\right]El \qquad (6)$$

Where l is the Heaviside unit function of time.

These solutions were obtained by converting formulas (2) and (4) into forms to be found in a table of operational formulas.

A convenient method of calculating the inductance, L, of a choke coil is given by Nagaoka's formula.[3] This formula is:

$$L = 4\pi^2 a^2 \frac{n^2}{b} K - 4\pi a n (A + B) \qquad (7)$$

where a is the radius of the coil, n is the total number of turns of wire, b is the length of coil, K is a correction factor that introduces the effect of the ends of the coil and A and B are constants depending upon

[2] "*Lightning Studies of Transformers by the Cathode-Ray Oscillograph*," F. F. Brand and K. K. Palueff, A.I.E.E., July, 1929. Refer to section on "*Effect of Inductance in Series with Transformer.*"

[3] *Bulletin of Bureau of Standards, Vol. 8, 1912, page 119.*

the size of wire, the pitch of the winding and the number of turns.

Constants K, A and B are given in tables which accompany Nogaoka's formula. A typical choke coil, capable of carrying 400 amp. on a 110-kv. system, has the following dimensions:

Diameter of wire = 0.56 in. (1.422 cm.).
a = 6.46 in. (16.4 cm.).
b = 24.0 in. (60.95 cm.).
n = 16.

For a coil of the above dimensions the constants A, B and K have the following values:

A = —0.4294
B = 0.2880
K = 0.8066.

Converting all dimensions to centimeters and substituting in equation (7).

L = 36.5 microhenries.

Using this value of inductance and taking Z_1 and Z_2 equal to 400 ohms, which is a good average value for a 110-kv. line, voltages e_a and e_b become:

$$e_a = E\,(1 + \epsilon^{-2.19\times 10^7 t}) \quad (8)$$

$$e_b = E\,(1 - \epsilon^{-2.19\times 10^7 t}) \quad (9)$$

Equations (8) and (9) are plotted in Fig. 2. The voltage at (a) immediately jumps to a voltage $2E$ and decreases exponentially to practically E volts in about 0.2 microsecond. The voltage at (b) starts at zero and increases exponentially to practically E volts in the same length of time.

The choke coil reflects a small part of the energy of the wave back onto the line and changes the wave front slightly. For all practical purposes this change of wave front is entirely negligible; that is, a transformer located at the end of line (2), Fig. 1, would be subjected to practically the same conditions as if no choke coil were used.

If a lightning arrester were located at (a), the increase in voltage at that point due to the choke coil would hasten the discharge of the arrester. Since the time lag of a lightning arrester sphere-gap is in the order of magnitude of 0.1 microsecond, this effect might be of considerable benefit, if vertical waves actually existed.

Case of Typical Lightning Wave:

Perpendicular wave fronts are, of course, never found in practice. The few cathode-ray oscillograms [4,5,6] that have been obtained of actual lightning waves show them to be of the general form shown in Fig. 6. This wave consists of the sum of two exponential curves and has the equation:

$$e_v = \frac{K\,E\,(\epsilon^{-b_1 t} - \epsilon^{-b_2 t})}{\pi} \quad (10)$$

where K, b_1 and b_2 are constants and E is the maximum voltage. In this paper wave fronts of 1 microsecond and 7 microseconds duration are considered. With the exception of direct strokes, it is difficult to conceive of wave fronts of less than one microsecond existing in reality, because a certain length of time, which is estimated at from 1 to 10 microseconds,[6] is required for clouds to discharge, and because the bound charge on the transmission line tapers from a maximum directly under the cloud to nearly zero about a mile from the edge of the cloud. It is believed, and cathode-ray oscillograms indicate, that wave fronts of from one to many microseconds duration may be encountered, the average being in the order of magnitude of 7 microseconds.

A 7-microsecond front wave which decreases to one-half the peak voltage in 23 microseconds has the following equation:

$$e_v = 1.85\,E\,(\epsilon^{-5.75\times 10^6 t} - \epsilon^{-28.75\times 10^6 t})$$

[4] "Cathode-Ray Oscillogram of Lightning Surge," "General Electric Review," Vol. 31, 1928, page 467.
[5] "Theoretical and Field Investigations of Lightning," C. L. Fortescue, A. L. Atherton and J. H. Cox, "A.I.E.E. Journal," April, 1929.
[6] "Lightning," F. W. Peek, "A.I.E.E. Journal," April, 1929.
[7] "Elec. Circuit Theory," J. R. Carson, page 16.

The response of the lumped inductance choke coil considered above to this voltage wave may be derived from equations (5) and (6) by means of the Carson "extension formula,"[7] or by substituting the operational expression for e_v in equation (2) and (4). The solution is:

$$e_a = 2K\left[\frac{(g-d)\,(b_2-b_1)}{(d-b_1)\,(d-b_2)}\epsilon^{-dt} + \frac{g-b_1}{d-b_1}\epsilon^{-b_1 t} - \frac{g-b_2}{d-b_2}\epsilon^{-b_2 t}\right]E \quad (11)$$

$$e_b = 2K\left[\frac{g\,(b_2-b_1)}{(d-b_1)\,(d-b_2)}\epsilon^{-dt} + \frac{g}{d-b_1}\epsilon^{-b_1 t} - \frac{g}{d-b_2}\epsilon^{-b_2 t}\right]E \quad (12)$$

where:

$$g = \frac{Z_2}{L}$$

$$d = \frac{Z_1 + Z_2}{L}$$

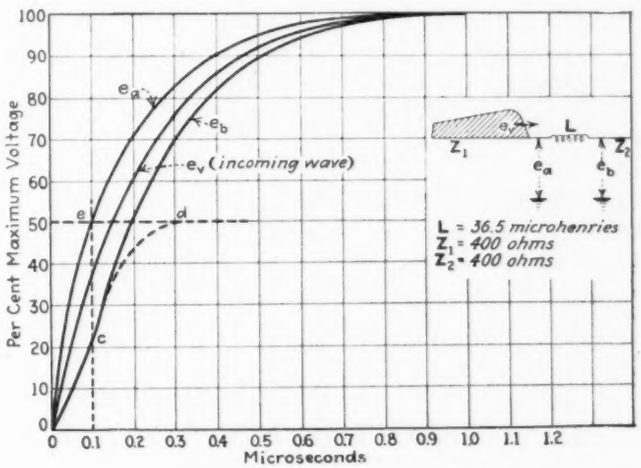


Fig. 4—Effect of Choke Coil on a One Microsecond Front Wave

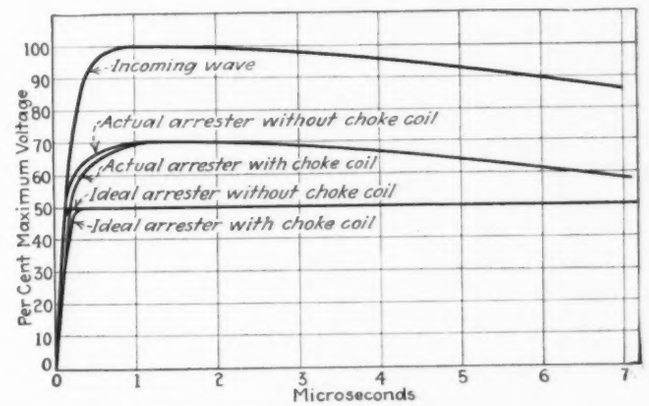


Fig. 5—Comparison of Lightning Arrester With and Without Choke Coil

Using the same values for Z_1, Z_2, and L, as before, these equations are plotted in Fig. 3. Only the fronts of these waves are shown, the tails being practically coincident. It is evident that the effect of the choke coil is entirely negligible. Not only does the surge pass through the coil without appreciable attenuation, but there is only an exceedingly small increase of voltage above that of the original wave at the line side of the coil to assist a lightning arrester located at that point.

Short Waves Affected More

As the wave front becomes shorter the coil, of course, becomes more effective. This is shown in Fig. 4, where the wave front has a duration of one microsecond. At first glance it would seem that, in this case, the choke

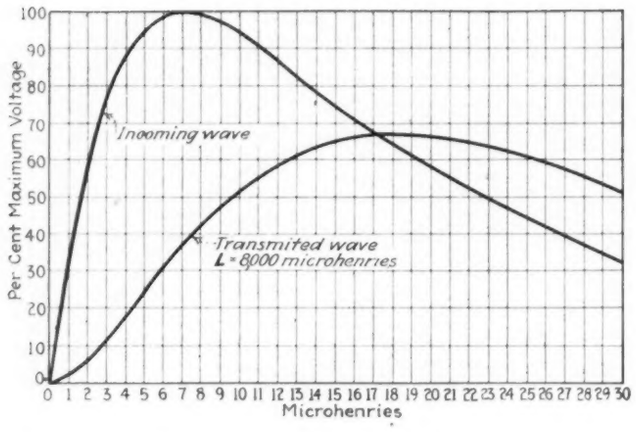


Fig. 6—Effect of 8,000-Microhenry Choke Coil on Lightning Wave

coil might be of considerable practical value. However, consider the conditions when a lightning arrester is located on the line side of the coil. On a hydro-electric system a theoretically ideal arrester would be set to discharge at slightly above three times normal voltage to avoid continual discharging due to switching surges. If this setting corresponded to about 50 per cent of the peak voltage of the incoming one-microsecond front wave, maximum benefit would be derived from the choke coil. Referring to Fig. 4, the ideal arrester would start to discharge when e_a reached point (c), and e_a would then remain constant until the voltage of the incoming surge decreased to 50 per cent peak voltage on the tail of the wave. At the instant e_a reached point (c), e_b would be about 23 per cent of the peak voltage as shown by point (c). The transmitted wave would then increase along the dotted line cd, reaching the maximum voltage permitted by the lightning arrester in about 0.2 microsecond. The choke coil would, therefore, lengthen the wave front of the transmitted surge by only 0.15 microsecond, as shown more clearly in Fig. 5. The behavior of an actual lightning arrester is indicated by curve A, in which case the choke coil would be even less effective, the transmitted waves with and without the choke coil reaching the same peak voltage at practically the same time. If the discharge voltage of the arrester occurred nearer the peak voltage of the incoming wave the influence of the choke coil would be still less. It is evident that the effect of a choke coil of 36.5 microhenries on one-microsecond front waves is entirely negligible.

The analysis thus far has assumed the lines on either side of the coil to be very long, so that reflections at their distant ends did not have to be considered.

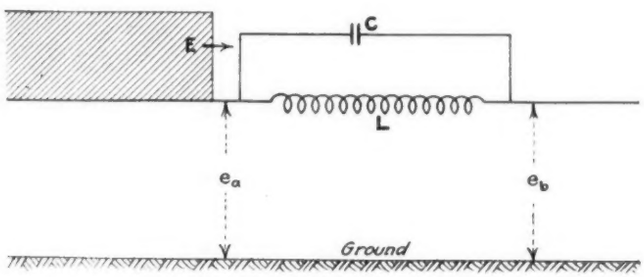


Fig. 7—Schematic Representation of Choke Coil With Capacity Included

Actually, line 2, Fig. 1, would terminate in a bus structure to which transformers, circuit breakers and other equipment would be connected. The wave impinging upon this network would be reflected in a manner depending upon the capacitances and inductances of the bus structure, circuit breaker bushings, transformers, etc., An accurate solution of this problem would be practically impossible. However, we are at present interested only in the effect of the choke coil and it is not necessary to complicate the analysis by introducing the effect of transformers, bus structures, etc. It has already been shown that the voltage wave arriving at the transformer would differ from the original wave only by a negligible amount. Therefore, the voltage reflected by the transformers, etc., would be practically the same with the choke coil as without. Upon reaching the choke coil this reflected wave, like the original wave, would continue on practically unchanged, and the effect of the choke coil would still be of negligible magnitude. If it is still desired to introduce the effect of the bus structure and its connected apparatus, this may be done by considering the apparatus to act first as a capacitance and then as a large inductance. Such an analysis is complicated by the fact that it is not known what values to assume for these factors. If this reflection were such as to cause an increase of voltage at the bus the lightning arrester would "cut off" the reflection just as it did the original wave.[1] However, a little thought will show that in the case of the reflected wave the choke coil would hinder the arrester. Thus, the negligible benefit that was gained from the choke coil at first would be nearly nullified. There is the added disadvantage that the successive reflections back and forth between the choke coil and transformers would be apt to result in higher voltages than would exist if no choke coil were used. It is hoped that these problems will be clarified in the near future by direct experimental data.

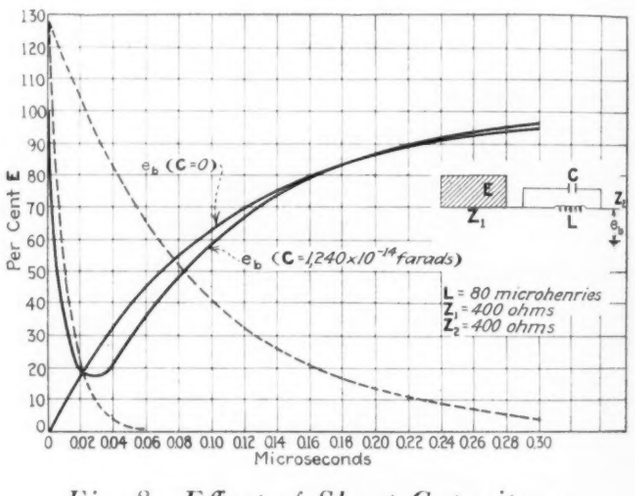


Fig. 8—Effect of Shunt Capacitance in Choke Coil Action

In order appreciably to reduce the peak voltage of the wave transmitted through the choke coil inductances many times the present values would be required. To give some idea of the necessary inductance, the effect of an 8,000-microhenry choke coil on a 7-microsecond front wave has been calculated. The peak voltage transmitted is 67 per cent of that of the impinging wave and reaches this value in 18 microseconds, as shown in Fig. 6.

A single-layer, air-core choke coil of this inductance would occupy a space about 9 ft. long and 8 ft. in diameter. Even if choke coils of this size were feasible, they would be of doubtful benefit due to dangerous oscillations which would be set up between the choke coil and transformers.

Effect of Distributed Capacitance:

The above discussion has neglected the capacitance between the turns of the choke coil and the capacitance between turns and ground. As shown in Fig. 2, a wave impinging upon a lumped inductance devoid of capacitance is completely reflected at the first instant. The effect of distributed capacitance in the coil is to make this reflection incomplete at the first instant. In order to analyze this case mathematically, it is convenient to idealize the problem by assuming the distributed capacitance to be lumped and shunted across the entire inductance as in Fig. 7.

For this case:

$$N(p) = \frac{L(p)}{1 + CL(p)^2}$$

The solution for e_b for the case of a perpendicular wave is:

$$e_b = \frac{2Z_2}{Z_1 + Z_2}\left[1 + \frac{1 + B^2 CL}{CLB(B - A)}\epsilon^{-Bt} - \frac{1 + A^2 CL}{CLA(B - A)}\epsilon^{-At}\right]E \quad (13)$$

where $AB = \frac{1}{CL}$

$$A + B = \frac{l}{(Z_1 + Z^2)C}$$

This equation is plotted in Fig. 8, where the following values have been assumed:

$Z_1 = 400$ ohms
$Z^2 = 400$ ohms
$L = 80$ microhenries
$C = 1{,}240 \times 10^{-14}$ farads

This value of C may be considerably in error, but it will serve to give at least a qualitative picture of the effect of distributed capacitance. It is seen that at the first instant the shunt capacitance acts like a short circuit across the coil and tends to counteract the effect of the inductance. Instead of a complete reflection there is no reflection at all the first instant. The best choke coil is, manifestly, one which possesses no capacitance between turns. As the capacitance becomes larger the two component curves of the transmitted wave, shown dotted in Fig. 8, become more nearly the same, until a point is reached when they are coincident, and the wave passes through the coil without reflection. In other words, the surge impedance of the coil becomes equal to that of the line. Actually, the capacitance in a coil is too small to be considered, but theoretically the calculations which neglect it are slightly optimistic. Consequently, capacitance need no further be considered.

Conclusions

Based on the calculations and examples presented in this paper, it would seem that choke coils of ordinary construction as used at present are of little practical value as a means of protecting station equipment against transmission line surges. In fact, it is probable that they do considerable harm by setting up oscillations which give rise to dangerous voltages. This danger of resonance is often underestimated. In order appreciably to effect traveling waves choke coils of from 50 to 100 times the inductance of the present type would be necessary. However, inductances of this size would probably do more harm than good by setting up dangerous oscillations in transformers. Initially, a large part of the voltage of the incoming wave would appear across the choke coil, while, finally, practically all the voltage would appear across the transformer. This readjustment of voltage and energy would be accompanied by high-frequency oscillations which would cause the transformer voltage to rise above that of the original wave.

Wants May 4 Issues

Twenty-five copies of the May 4, 1929, issue of Electrical World are needed. For the first 25 received D. E. Bigelow, McGraw-Hill Publishing Company, Inc., offers to pay 50 cents per copy.

Simplified Over-Voltage Test for Meter Coils*

OVER-VOLTAGE testing of watt-hour meter coils has proved quite indispensable as a part of regular routine in a meter repair laboratory. All meters which have been repaired should have each set of coils given an over-voltage test. Such testing will disclose grounded coils, leads and terminals which are frequently found to have occurred to a meter in service or in transit. Well-insulated meter coils insure safety to those who may come in contact with the meter and insure complete registration of energy, particularly so on grounded secondary systems.

With proper equipment the cost of this operation is quite small. One of the larger utilities has developed equipment for this work consisting of a specially wound transformer having a B-shaped core, in the middle leg of which there is an air gap. The primary is wound on one outside leg and is designed for continuous service on 115 volts. The secondary is wound on the other outside leg and is designed to deliver 2,300 volts when 115 is impressed on the primary. The secondary is tapped to render lower voltages of 800, 1,200, 1,800 and 2,000. Taps are quickly changed by radial dial switch, controlled by a properly insulated knob mounted on the front of an assembly and insulating panel.

A third or auxiliary winding is placed on the middle leg of the core to one side of the air gap. This winding supplies energy to a buzzer and to a 6-volt lamp which is mounted behind a red lens on the front of the panel. The air gap and auxiliary winding are so proportioned that leakage flux across the gap is sufficient to show a dull lamp, but not to sound the buzzer when secondary is open circuited, indicating that the equipment is energized. A short circuit on the secondary of the high voltage terminals increases the impedance through that circuit, causing more flux leakage through the air gap. This flux is sufficient to light the lamp at full brilliancy and to sound the buzzer, thus giving both an audible and visible signal of a short circuit.

Primary leads consists of two-conductor No. 16 "Tyrex" portable cord, equipped with plug for attachment wall receptacle. Supply to this equipment is controlled by an indicating toggle switch mounted flush with the surface of the installed panel.

Secondary or high-voltage leads are two separate good quality ignition cables. The end of each of these leads is equipped with a round micarta handle for increased insulation and for holding the test electrodes. An insulating disk mounted on the end of each handle prevents the workmen's hands from sliding into contact with the electrodes.

As meters are brought to or taken away from the repair or test benches they are placed on a special rubber-tired meter buggy, of which all framework supporting the meters is metal. One electrode is placed in contact with this metal frame, which is of the same polarity as all meter bases mounted thereon.

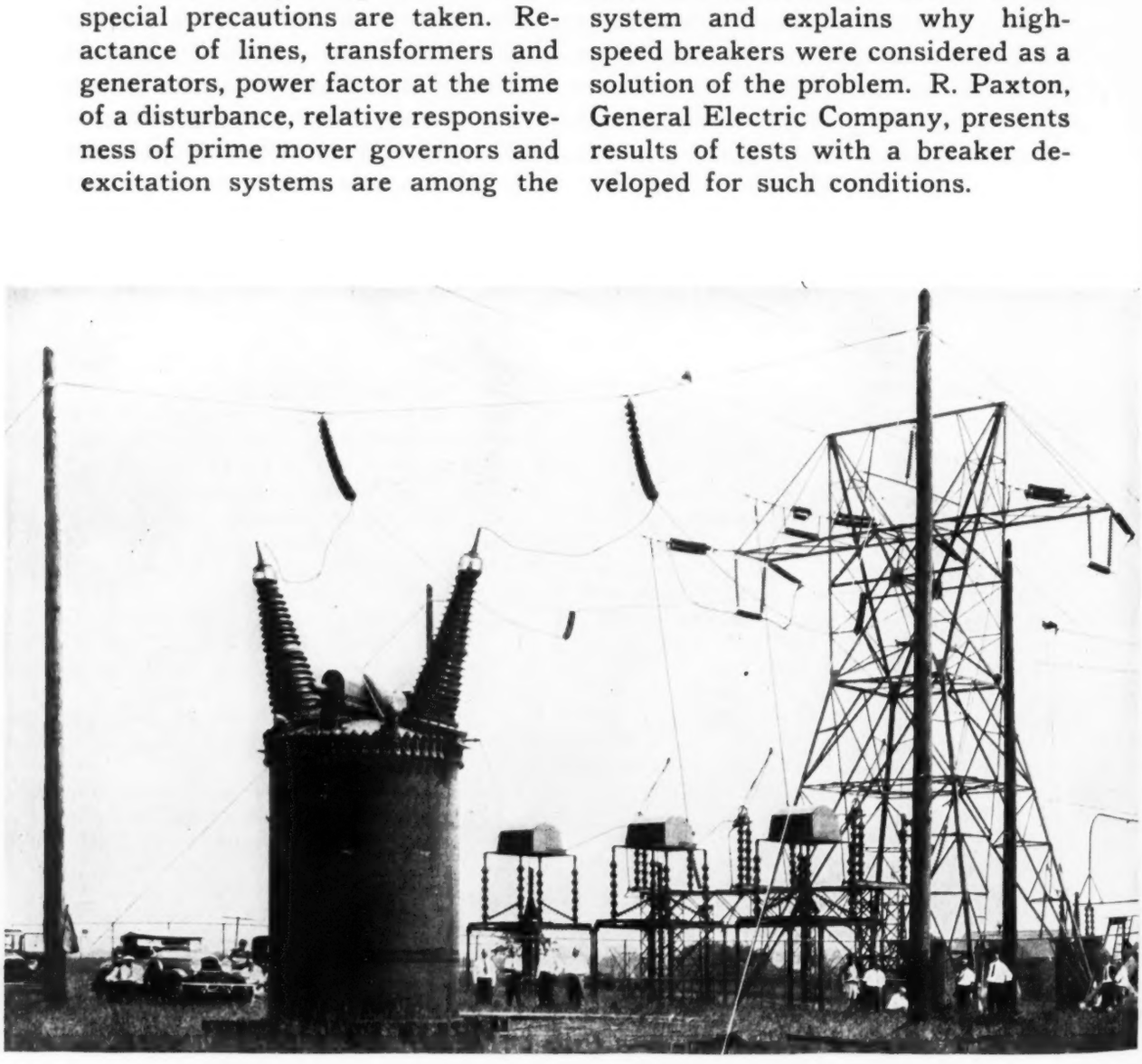
**Excerpts from meter committee report, Pennsylvania Electric Association.*

High-Speed Breakers

Conditions which dictated their serious consideration on Philadelphia system and results of tests

WITH the increase in interconnection and the consequent linking together of lines and power units of different characteristics, conditions are likely to result that are unfavorable to stability of operation unless special precautions are taken. Reactance of lines, transformers and generators, power factor at the time of a disturbance, relative responsiveness of prime mover governors and excitation systems are among the factors which will determine the experience with widespread parallel operation.

In what follows, E. K. Lewison, Philadelphia Electric Company, relates a situation that arose on his system and explains why high-speed breakers were considered as a solution of the problem. R. Paxton, General Electric Company, presents results of tests with a breaker developed for such conditions.



High-Speed Breaker Under Test at Plymouth Meeting Substation

Need for High-Speed Breakers

Effect of low-speed waterwheels, transmission reactance and power factor on stability. Conditions that demand high-speed breaker

By E. K. Lewison
Philadelphia Electric Company

TRANSMISSION of the initial output (252,000 kw.) of the Conowingo hydro-electric plant over two 220-kv. lines to Philadelphia, a distance of about 60 miles, presented a serious problem, on account of the probability of unstable operation of the plant during a fault on the transmission system. First of all, low-speed waterwheel-driven generators run out of step much more quickly than steam-turbine-generators on reduction or loss of load during fault conditions. Then it is necessary to know whether or not stability of operation will be maintained under transient conditions. Unfortunately calculations for transient stability include a number of factors which are very difficult to evaluate. Besides, at the time the engineering work was being done for the Conowingo development there were substantially no test results on this subject with which calculations could be compared. Studies that were made indicated that, in order to obtain maximum synchronizing power, the following steps should be taken:

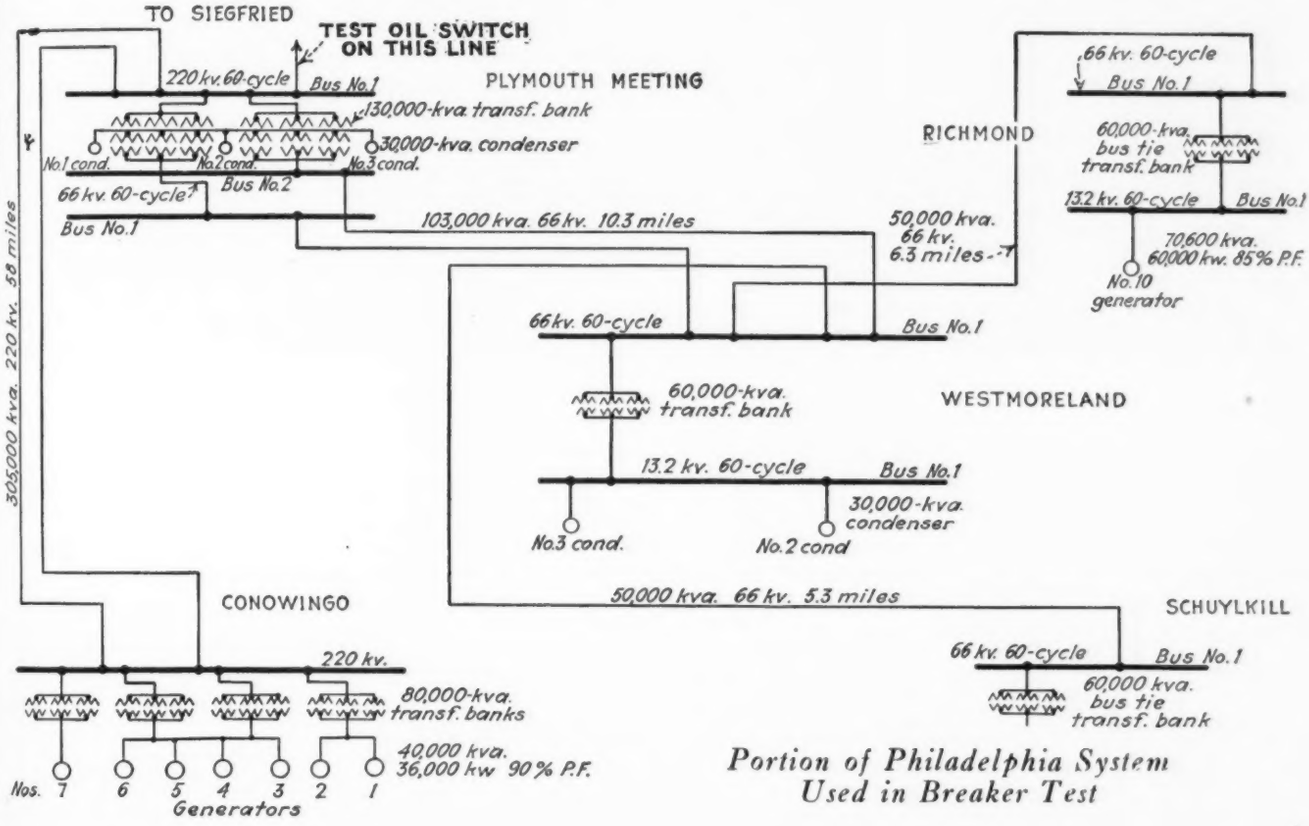
(a) Reactance of the transmission system, including the Conowingo generators and step-up and step-down transformers, should be as low as practicable.

(b) Synchronous condensers should be used, particularly at the point of tie-in with the Philadelphia system, to introduce leading kva. at time of fault.

(c) Synchronous machines, such as these condensers and the Conowingo generators, should be provided with high-speed excitation.*

The studies referred to were based on flashover of one line conductor to ground, but during the first summer's operation a total of three flashovers were experienced on the Conowingo 220-kv. lines, all involving two, or possibly three, conductors.

A record obtained by the use of an automatic oscillograph during the trouble experienced on August 17, 1928, is illustrated. From this oscillogram it may be noted that the generators ran out of step very rapidly. While the exact time cannot be determined, on account of the delay introduced by the starting mechanism of the oscillograph, it is evident that they were so far ahead of the steam system generators before the fault was cleared that they would not pull back into synchronism. They continued to run out of step until either their over-speed devices or the large synchronizing current over the sound line automatically disconnected them.

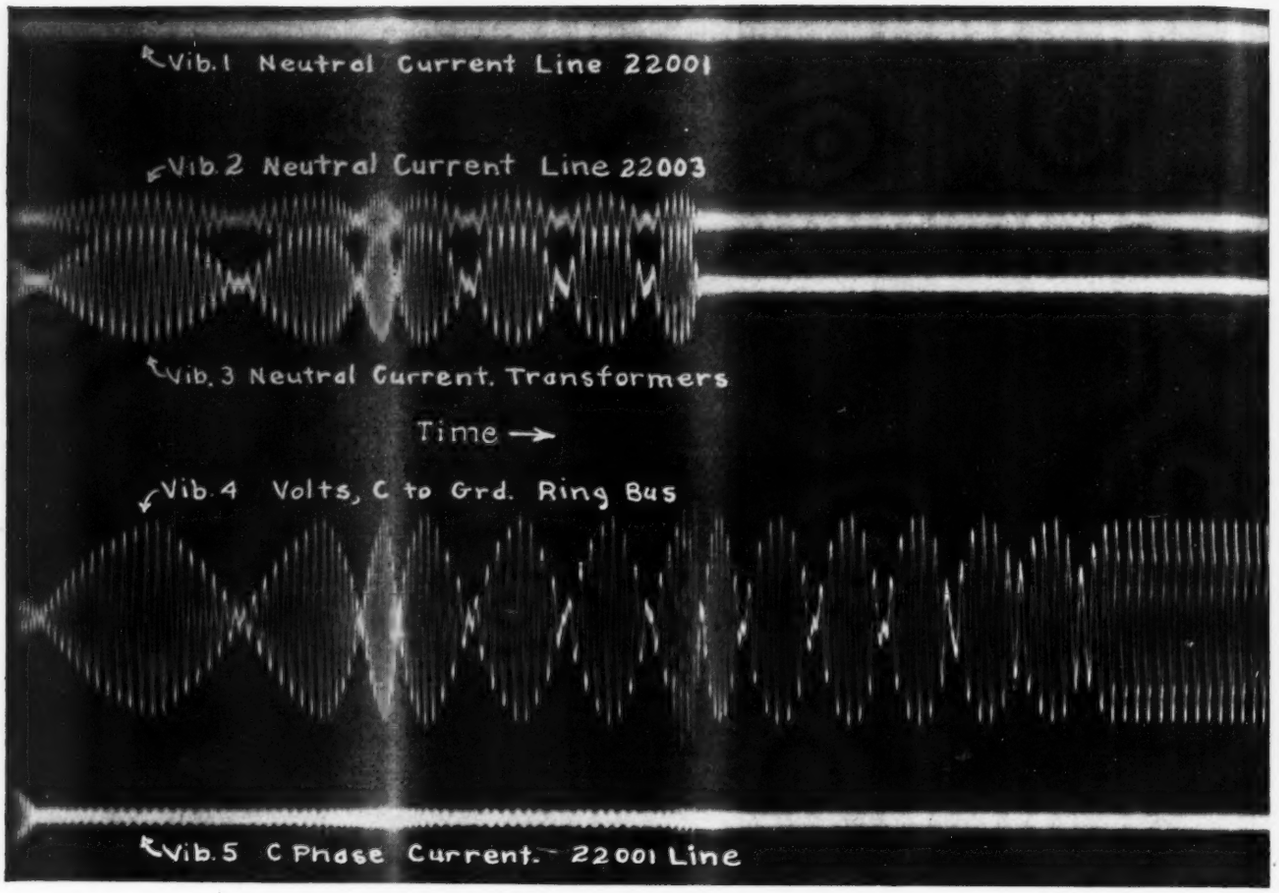


Portion of Philadelphia System Used in Breaker Test

This experience with faults involving two conductors and ground led to a review of the system stability situation. Conclusions were reached that under this condition the solution of the problem would likely lie in the use of high-speed circuit breakers, which would isolate the fault before the generators could advance far enough to pull out of step. The use of high-speed breakers apparently possesses a number of additional advantages, such as minimizing the disturbance to load equipment.

Calculations made by several engineers indicated that with Conowingo output at 252,000 kw. unstable opera-

**The excitation system of the synchronous condensers at Plymouth Meeting, which is arranged for a very high speed of response, is described by Robert Treat in his article on "Field Tests of Super-Excitation" in the June, 1929, issue of the "General Electric Review."*


Vib.1 Neutral Current Line 22001
Vib.2 Neutral Current Line 22003
Vib.3 Neutral Current. Transformers
Time →
Vib.4 Volts, C to Grd. Ring Bus
Vib.5 C Phase Current. 22001 Line

Case of Instability in Which Waterwheels Pulled Out of Step with Steam Units

tion will not result during a fault involving two conductors and ground, if this fault is cleared in 8 to 11 cycles. To clear a short circuit involving all three line conductors satisfactorily would obviously require a shorter time than 8 to 11 cycles, possibly of the order of 5 or 6 cycles. This indicates the need for a circuit breaker which will open in materially less time than existing breakers, and also for a relay protective system which would operate with substantially no time delay. Accordingly the manufacturers of the oil circuit breakers which are in service at Conowingo and Plymouth Meeting were asked to develop new designs of oil circuit breakers or preferably modify the breakers now in service so they would operate with sufficient speed to obtain the desired results. Inasmuch as short-circuit currents far greater than are now available for factory test equipment could be developed on the Conowingo system, field tests were decided upon.

On two Sundays—August 11 and 18—a modification of the type FHKO-139 General Electric breaker, with a rating of 187 kv. and 2,500,000 kva. interrupting capacity, was tested. The breaker tested was a single-pole unit. It was first connected phase-to-ground and tested at 1,200, 2,200 and 3,000 amp. under both CO and OCO duties. Several tests with the breaker unit connected phase-to-phase were also made. The part of the system used for the test was entirely isolated from that carrying the load to avoid any interference with the customers' loads.

The test breaker was connected in the Siegfried line, which was opened at the Siegfried substation end. The breaker regularly controlling this line was used for closing in on the "short" during the CO tests and as "back-up" protection. In the phase-to-ground tests one terminal of the test breaker was connected to the neutral of the 220-kv. transformer banks by means of the general station grounding system.

Results of these tests are described in the following paper by Robert Paxton of the General Electric Company, whose co-operation was a large factor in the successful conduct of the tests.

Results Obtained

Average arc duration on CO short circuit was 3 cycles and average breaker operating time was 8.4 cycles.

By R. Paxton

Switchgear Engineering Department, General Electric Company

FOR some years manufacturers have contented themselves with designing breakers which would produce the minimum amount of gas, show the least possible tank pressures and give as little indication as possible of distress when interrupting heavy short circuits. The over-all time taken to interrupt the circuit was, in general, secondary to the design and more attention was paid to controlling the arc duration than the breaker operating time.

However, nearly every system stability study which has been reported concludes with the statement that apparently the only solution to the problem would be in the development of higher speed oil circuit breakers.

Numerous charts showing the power limits on existing lines with various short-circuit durations have most forcibly brought to the manufacturer's attention that a new factor must be considered in the design of future oil circuit breakers.

In view of the demand for higher speed switching, the General Electric Company has made an extensive investigation of its oil circuit breakers and has made a number of tests, some of which have been in the field, to determine just what could be done to breakers designed along more or less conventional lines. In making this investigation it was felt that the explosion chamber breaker would lend itself best to operation at higher speeds, and consequently the investigation, so far, has been largely on this type of breaker.

In any oil circuit breaker the time of operation naturally breaks up into three parts:

First—The time required to disengage the trip mechanism and start the breaker in motion.

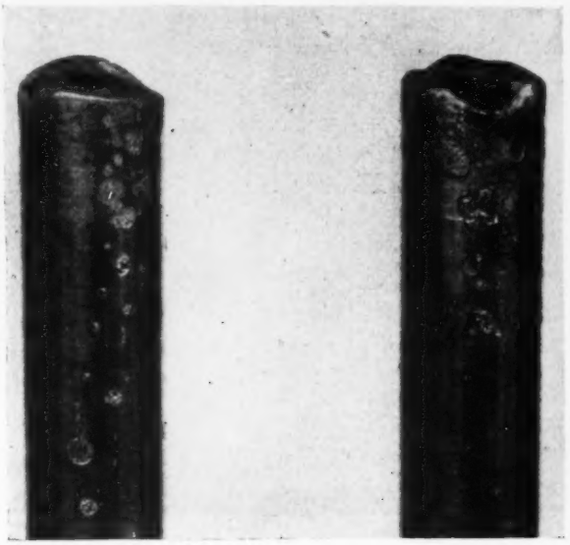
Second — The time measured from the start of motion to the time when the arcing contacts part.

Third — The time from parting of the arcing contacts until the circuit is interrupted.

It has become generally recognized that the time from the parting of the contacts until the oil circuit breaker reaches its extreme open position is not a constant quantity for explosion chamber breakers. The pressure developed in an explosion chamber acting upon the contact rods develops a piston action which accelerates the traveling contact proportional to the amount of current being interrupted by the breaker. On moderate voltage circuits under full interrupting duty the time from parting of the contacts until fully opened averages approximately 40 per cent of the no-load time, while for the higher voltages this ratio varies between 50 and 60 per cent.

While this inverse time characteristic was a desirable one, the need for a breaker which would have a minimum operating time for all values of short-circuit current has arisen. Various theories were evolved and a sample 220-kv. single-pole oil circuit breaker was built to check these theories.

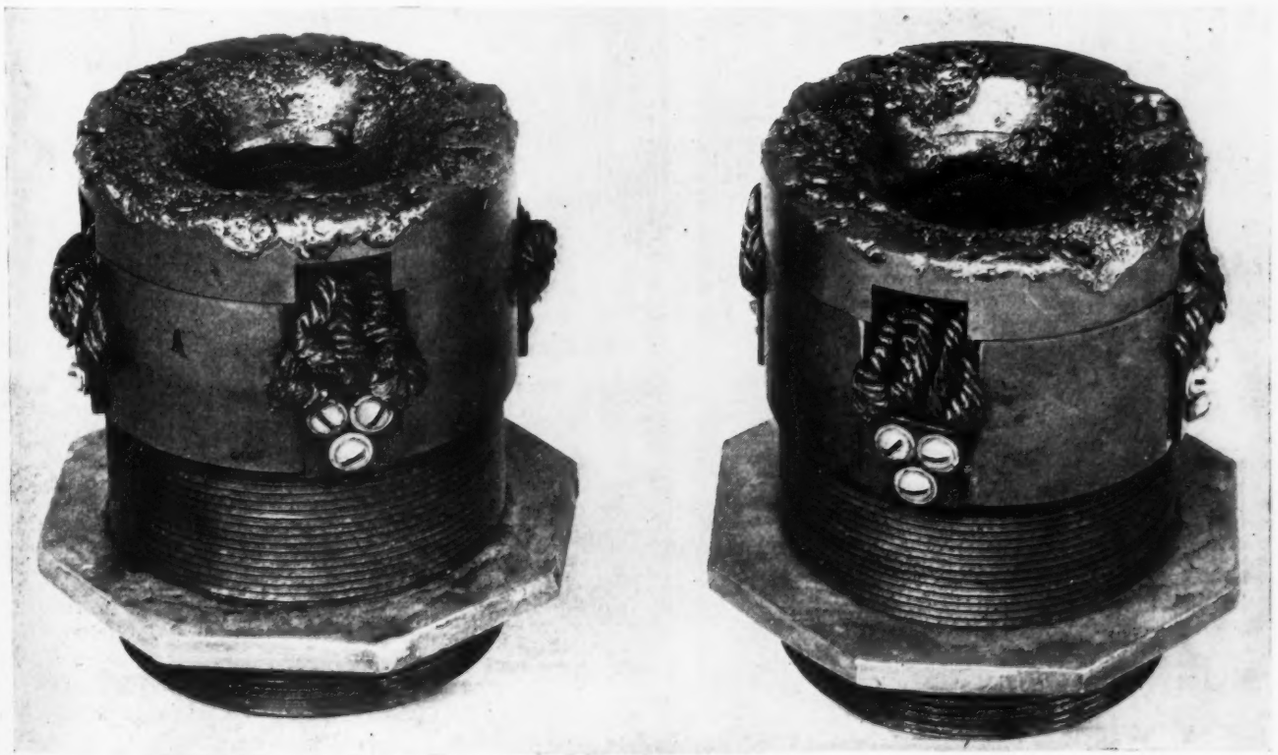
In order to decrease the time of items Nos. 1 and 3 the oil circuit breaker was provided with an opening mechanism of very high speed. In order to decrease the value of item No. 2, new butt-type line contacts were developed. With this type of breaker the time from



Ends of Contact Rods Used in First Fifteen Tests

Stationary Contacts Used in All Tests

The burning was not great considering the number and severity of the tests.



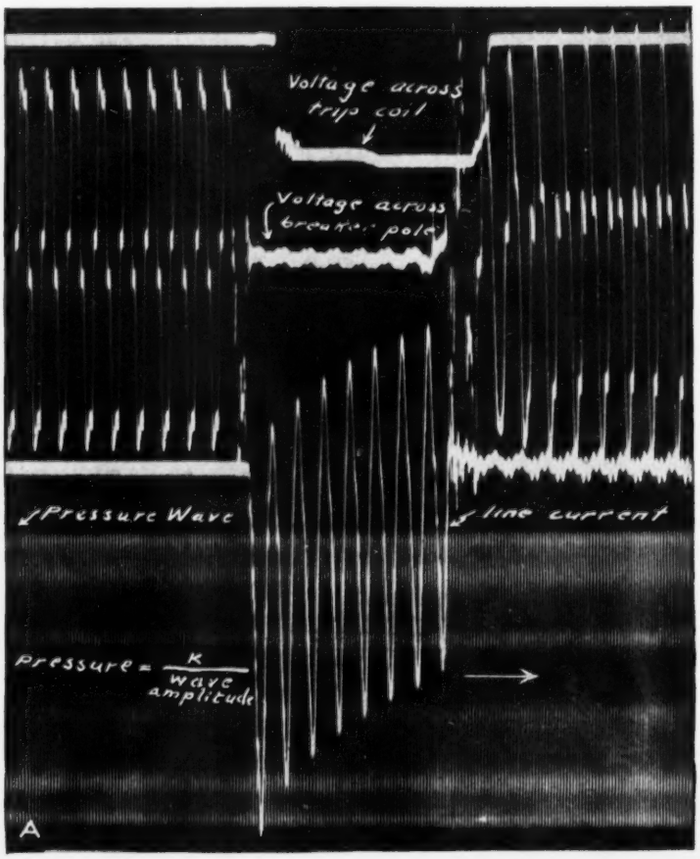
energizing the trip coil until the parting of the contacts was reduced to 5 cycles (on a 60-cycle basis). The general design of the oil circuit breaker was similar to the standard types and modifications were, in general, simply in the direction of higher speed.

In order to check this design arrangements were made with the Philadelphia Electric Company to make short-circuit tests on its 220-kv. system. The system set-up has been described by K. E. Lewison in his article "Need for High-Speed Oil Circuit Breakers and Methods of Testing." Due to the limitation of time, a single-pole breaker was built. Since this is a grounded system and since it is expected that all faults would involve ground, it was thought that a single-pole breaker tested on phase-to-ground faults would receive approximately the same or more duty as each unit of a triple-pole breaker under equivalent conditions.

The maximum ground fault current which could be obtained was approximately 3,000 amp. In order to make the tests cover as wide a range as possible short circuits were interrupted at values of approximately 1,200, 2,200 and 3,000 amp.

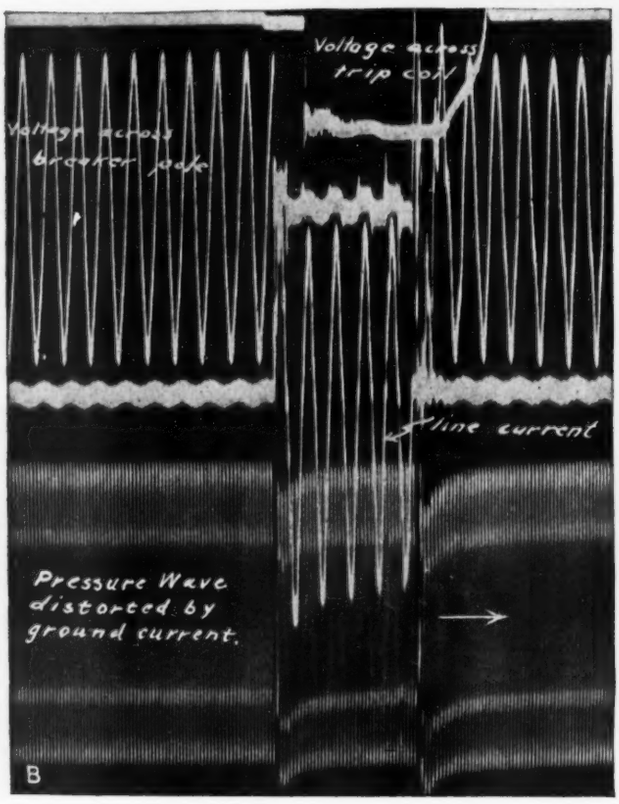
On August 11 and 18 a number of short-circuit tests were made, demonstrating that the modified oil circuit breaker had an operating time very considerably lower than that of the conventional oil circuit breakers and indicating that still furthur reductions were possible of attainment. The data obtained from these tests are presented in Table I.

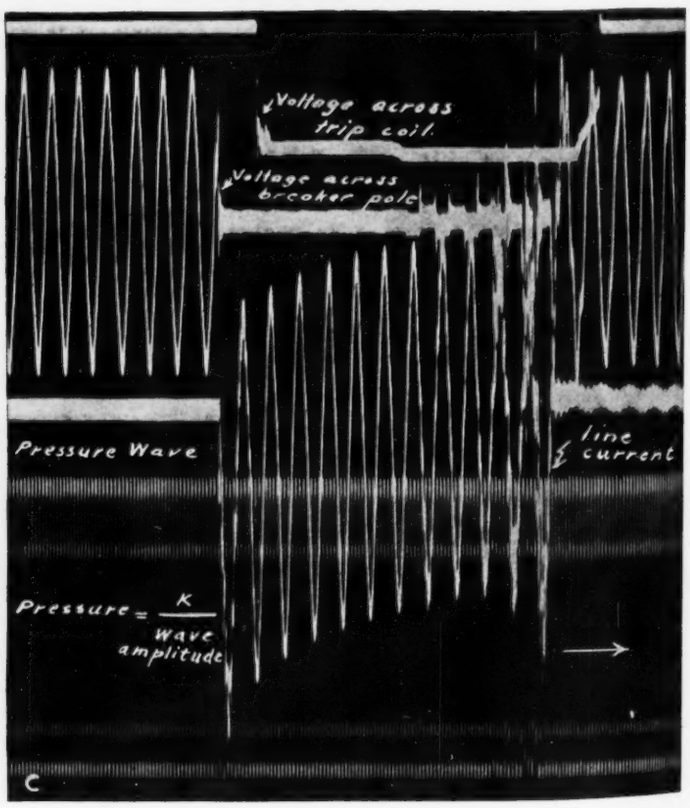
In reviewing the data it will be noted that in a number of the OCO tests the number of cycles of arcing is equal to the short-circuit duration. This is characteristic of a high-speed, trip-free oil circuit breaker. The arc strikes between contacts before these contacts



A Few Records Taken During Tests

A—A typical line-to-ground CO short circuit of about 1,200 arc amp. B—A rather exceptional line - to - ground OCO short circuit of 2,200 arc amp., indicating possibilities of further improvement. C—A CO line-to-line fault of 2,200 arc amp.





have engaged, the over-current relay operates and the circuit is interrupted, in a number of cases, without the breaker contacts actually coming together. Consequently it is very difficult to determine the arc duration on opening during OCO tests. However, the time is readily determined in the CO results under the same system condition.

It will be noted that the average arc duration on a CO short circuit is approximately 3 cycles for all tests. The average breaker operating time is 8.4 cycles. Only 36 per cent of the time is used in actually interrupting the circuit, while 64 per cent of the time is lost in getting the oil circuit breaker contacts separated. It is obvious that with such a set-up still further reduction in over-all time may be obtained.

With all available power units connected to the system the maximum short-circuit current obtainable was approximately 46 per cent of the breaker interrupting capacity rating.

In order to obtain design data for the development of oil circuit breakers for voltages higher than 220 kv. it was decided to make four tests in which the single-pole unit would interrupt line-to-line short circuits (not including ground). It is obvious that this test gives equivalent duty to that which would be obtained by interrupting a single line-to-ground-fault on a 380-kv. system. The results of these tests are given in Table II.

It will be noted that the increase in arc duration is only moderate. It can safely be concluded from these tests that no further increase in oil circuit breaker size will be necessary if system voltages are increased to 330 kv. with the exception of those changes found necessary for increased insulation.

Table I—Results Obtained with Modified Oil Circuit Breaker Breaking Phase-to-Ground Short Circuits on 220-Kv. System

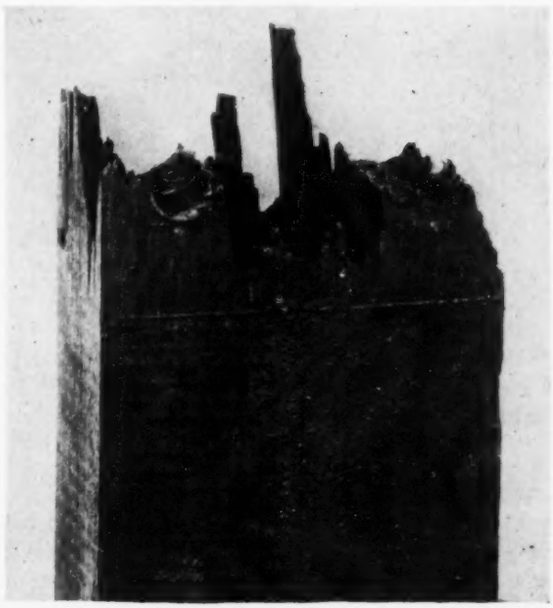
Test No.	Duty (CO-OCO)	Short Circuit Duration (Cycles)	Over-Current Relay Time (Cycles)	Breaker Operating Time (Cycles)	Cycle of Arc	Current in Arc (Amp.)	Equivalent 3-Phase Kva. ×1,000	Kv. Across Pole	Equivalent 3-Phase Kv.	Pressure Above Oil (Lb.)
1	CO	8.0	1.6	6.4	1.0	1,230	513	155	269	0
2	CO	11.0	1.25	9.75	3.5	1,155	542	156	271	0
3	CO	8.0	1.25	6.75	1.0	1,180	549	155	269	0
4	CO	8.0	1.25	6.75	0.5	1,170	491	152	264	0
5	CO	8.0	1.5	6.5	1.25	1,100	474	143	248	0
6	CO	9.5	1.25	8.25	3.0	1,135	508	149	258	0
7	OCO	9.0	1.75	7.25	9.0	1,085	415	127	221	0
8	CO	11.0	1.25	9.75	4.0	2,170	919	142	244	0
9	CO	10.5	1.5	9.0	3.25	2,270	974	143	247	0
10	CO	10.0	1.4	8.6	3.5	2,200	948	144	249	0
11	CO	10.5	1.25	9.25	3.5	2,300	910	132	229	0
12	OCO	9.0	1.5	7.5	9.0	2,110	836	132	229	0
13	OCO	5.0	1.25	3.75	5.0	2,155	832	.29	223	0
14	OCO	10.5	1.0	9.5	4.5	2,035	793	130	225	0
15	CO	10.0	1.25	8.75	3.25	2,900	1,160	133	230	0
16	CO	10.5	1.25	9.25	3.5	2,850	1,100	128	222	0
17	CO	10.5	1.25	9.25	3.5	3,080	1,280	.38	239	0
18	CO	10.5	1.5	9.0	3.75	2,940	1,260	143	248	0
19	OCO	8.5	1.25	7.25	6.5	3,030	1,230	136	235	0
20	OCO	11.0	1.25	9.75	5.0	2,.80	.170	136	235	0
21	OCO	10.0	1.5	8.75	3.5	2,940	1,220	138	239	0
22	OCO	11.0	1.75	9.75	4.75	2,990	1.245	.38	239	0
23	OCO	10.5	1.25	9.25	4.0	2,940	1,080	.28	222	0

Table II—Breaker Performance Interrupting Phase-to-Phase Short Circuit on 220-Kv. Line

Test No.	Duty (CO-OCO)	Short Circuit Duration (Cycles)	Over-Current Relay Time (Cycles)	Breaker Operating Time (Cycles)	Cycles of Arc	Current in Arc (Amp.)	Equivalent 3-Phase Kva. ×1,000	Kv. Across Pole	Equivalent 3-Phase Kv.	Pressure Above Oil (Lb.)
24	CO	11.5	1.6	9.9	5.0	2,115	933	255	441	0
25	CO	11.5	1.5	10.0	5.5	2,010	908	261	452	0
26	OCO	13.5	1.5	12.0	13.5	2,080	905	251	435	0
27	OCO	13.5	1.5	12.0	13.5	2,110	918	247	428	0

Minor Trouble Remedied

During the tests there were a few minor mishaps, such as are almost unavoidable in any field tests. A 2-in. fill valve on the oil circuit breaker unit was left open for the first eleven tests in the first table. On the eleventh test a small amount of gas was noticeable coming out of the fill valve, which was promptly closed. This is an excellent demonstration of the fact that there was no measurable pressure developed in the air space above the oil. On no tests was there any indication of tank pressure. After the fifteenth test a wooden operating rod was found to be broken, caused largely by improper manufacture. The wood rod which failed was subsequently replaced with one of improved manufacture and design which functioned satisfactorily.



Portion of Breaker Operating Rod Broken in Test 15

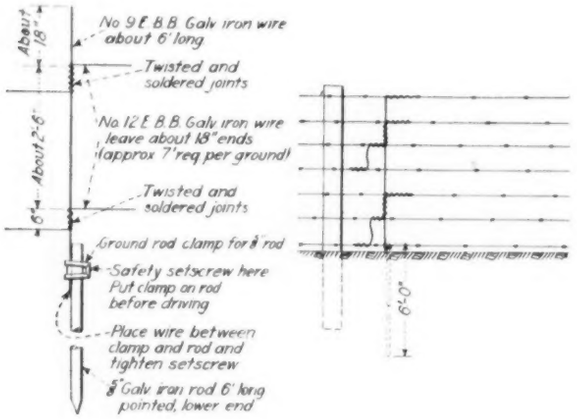
On one of the last four tests listed in Table II the pressure in the chamber on a line-to-line fault ruptured one of the two non-metallic explosion chambers. It is obviously only from field tests of this character that the empirical data covering the design of oil circuit breakers may be proved. Having determined the pressure developed in an explosion chamber on a line-to-line fault, it is a simple matter to control this pressure by making minor changes to the chamber assembly.

In examining the accompanying oscillograms it should be kept in mind that the short-circuit current was taken from a current transformer not located in the test breaker. The ragged zero line indicated after the short circuit is cleared is, in reality, charging current on the Siegfried-Plymouth Meeting line. It will be observed from illustration A on page 738 that the pressure wave is considerably distorted. This distortion was later found to be caused by ground current in the oscillograph pressure recorder circuit.

[*The General Electric Company wishes to express its appreciation for the courage and co-operation of the Philadelphia Electric Company, without whose aid these tests could not have been made.*]

Standard Fence Grounds Show Economies

THE cost of a transmission line may not be at an end when the conductors are up in the air and current is flowing through them. It is possible that very material expenses may be added at a later date if all of the items incident to the construction of a line were not adequately taken care of in the first instance. One of


About 1'-8"
No. 9 E.B.B. Galv. iron wire about 6' long
Twisted and soldered joints
No. 12 E.B.B. Galv. iron wire leave about 18" ends (approx. 7' req. per ground)
About 2'-6"
Twisted and soldered joints
6"
Ground rod clamp for ⅝" rod
Safety setscrew here Put clamp on rod before driving
Place wire between clamp and rod and tighten setscrew
⅝" Galv. iron rod 6' long pointed, lower end
6'-0"

Method of Grounding Wire Fences Along Transmission Lines

these items is the effective grounding of metallic structures adjacent to or paralleling the line, particularly wire fences. It is standard practice to protect such structures on many utility systems.

There is so much of this grounding work to be done that it was found to be a definitely economical measure by the Consumers Power Company on its large Michigan system to set up a standard manner for making fence grounds. The materials used can and usually are assembled prior to the installation, thus profiting by the saving that usually attends shop as against field construction assemblies.

The material for fence grounds consists of ⅝-in. galvanized iron rod 6 in. long with a pointed end to which is fastened by means of a suitable clamp a riser of No. 9 EBB galvanized iron wire about 6 ft. long. Double taps of No. 12 galvanized iron wire about 18 in. long are taken off this riser for attachment to the fence strand as is shown in the accompanying illustration. All joints except the one at the ground clamp are twisted and soldered.

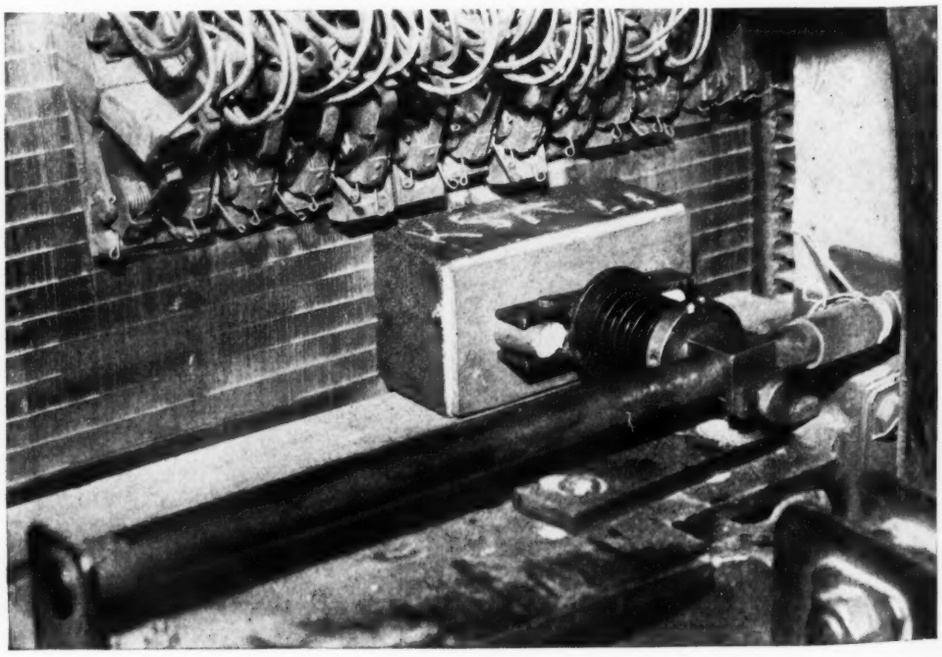
Ground rods are installed about every 500 ft. on fences paralleling a line and on both sides of the line on fences that cross under it. There are also installed, on both sides of gates, highway crossings and other openings in fences. No single piece of fence is connected to less than two grounds.

Safer Commutator Stoning

A NEWLY devised stoning board which not only smooths down the rough spots on commutators of rotary converters and generators but is also a safety device has been perfected by the electrical construction department of the New York Edison Company. It simplifies the work and can be operated with practically no danger to the man using it. There is also a vacuum cleaner attached which collects 60 per cent of the flying copper and stone dust. With the new device the man operating the stoning board does not have to touch it except to make adjustments. The stone is held in a rigid position on the board by a clamp. Just above the clamp is a heavy helical spring which gives the proper tension to the stone. The spring is supported by a threaded brass member, with an adjustable nut, to keep the tension uniform as the stone wears during the process. This part of the mechanism is in turn attached to the long bar known as the traveler. A man operating it simply has to regulate the tension with a wrench or, when one rough spot is cleared, move the stone grip along the traveler to reach another spot.

The stoning board is made of micarta material of high insulating quality and strength. All metal parts are insulated from the apparatus to be worked on. This reduces to a minimum the possibility of contact with any live parts.

This type of stoning board can be set up in ten minutes and dismantled just as quickly. It is attached to the d-c brush arm of the apparatus. By removing only one d-c brush-holder on the outer edge of the brush arm sufficient room is made for the vacuum attachment. Many stoning jobs on commutators have been performed with the stoning boards without an accident while doing this hazardous class of work.



Stoning Board Offers a Safer Way of Smoothing Commutators

Consolidations *and* Regulation

By M. S. Sloan*
President National Electric Light Association

Mergers will be publicly accepted to the extent that society shares benefits.

Industry should help keep regulation in conformity with changing conditions.

THERE is sufficient evidence within our industry to prove to us that consolidations and combinations, when wisely conceived and ably administered, do produce the benefits they were formed to bring about. Yet we should be blind if we did not recognize that these activities will progress and yield the desired results they are expected to yield only as and when they are understood and accepted by the public, which makes or unmakes business, and particularly our business as public utilities. The public will not accept this development in our business on the sole basis that it is necessary and good for us. It will be accepted only as it is proved to be good for the public also. In my judgment it has not yet been so proved to the public's complete acceptance. The public is manifestly suspending judgment.

The public will accept these mergers and consolidations just as soon as it is convinced they are in the public interest as well as in our interest. Benefits to society at large must come out of them as well as benefits to the companies concerned. These must be benefits that can be measured, understood, gossiped about by the rank and file of our customers.

As companies and as an industry we shall be judged, not by what we say or believe about the necessity of this phase of our progress or its benefits, but by results which the public can appreciate. It is up to us to produce such results. As we do this, the size of companies or combinations of companies will make no difference. The public is not worried about size as such, and is not necessarily afraid of the big concern more than the small one. What it wants is assurance that concerns grown huge are not also grown regardless of their obligation to the people they serve.

Therefore, we have a duty to the industry and a duty to the public in this situation. These duties coincide, for only by fulfilling our duty to the public can we properly fulfill our duty to the industry. If our companies benefit by consolidations and groupings, our customers also should benefit. If there are savings, the customers should receive their share of them. If the advantages of consolidation yield better operating conditions, larger sales, larger profits, the customers should get their advantages also in more current for less cost to them. This would not be altruism. It would be justice. Moreover, it would be plain business sense. It is now standard business practice in America to make your product as high grade as possible, to sell it at as low a price as possible, and to take the profits from the large volume of sales resulting. The power and light industry is doing that now to a considerable degree and is prospering as a result. The justification of larger units and more concentrated control in our industry will be the measure in which they enable us to extend and accelerate this practice. We shall be judged by results. It is up to us to produce results which speak for themselves.

We have a further obligation. People are, and I believe have the right to be, apprehensive lest the great combinations formed and forming grow beyond the control which it is deemed essential to have over public service organizations. It is often alleged that regulation of utilities has broken down or has failed to keep pace with changing conditions in the utility field. In New York State there is under way a legislative inquiry into the operation of regulation with a view to strengthening the law and its administration. The results of that investigation will undoubtedly have a far-reaching effect, producing similar undertakings in other states.

I do not believe regulation has broken down or failed. What it has accomplished is frequently not understood by its critics, and still less by the general public. It has contributed to the rapid progress of utilities and the improvement of utilities' service. It has been helpful to the utilities in establishing stable conditions for them, under which they could operate intelligently, knowing what they might do and what they might not do. This helped in obtaining the large sums of new capital necessary for our industry's expansion in recent years.

Wise Modification of Regulation Should Be Supported

Regulation has been valuable to the public. It affords an orderly procedure for hearing complaints and conducting investigations and has given assurance to the public against improper practices on the part of the utilities. It has done much for the public by holding the companies to high standards of service. It has been an important element in the establishing of fair and reasonable rates. This has by no means meant reductions in every case. Yet on the whole there has been a general lowering of rates by our industry over a period of years, and I think this may properly be attributed to the conditions set up by regulation.

Nevertheless, regulation, valuable as it unquestionably has been both to the utilities and the public, will be valuable in future only as it accurately and comprehensively reflects conditions which exist. Recognition of this fact ought to be put into effect by supporting all wise and

*Excerpts from address before Great Lakes division N.E.L.A.

well-directed efforts to bring laws into conformity with present conditions where they can be shown not to be so, to strengthen them properly, to extend them where extension is found to be necessary. There unquestionably is room for this in some states. I believe our industry can properly stand for stronger regulative commissions, better staffed and better equipped financially to do the job committed to them. Nothing but benefit for the public and the utilities can result from wise, able, expert regulation by state commissions made up of men who understand their subject.

Critics of state regulation are particularly outspoken at present in asserting that the public is unprotected, since public utility holding companies have not been brought within the scope of regulation. They clamor for regulation of holding companies. Some of the state commissions also have formally advocated the extension of regulation of operating companies to include regulation of holding companies. Here, it seems to me, we get into very difficult and debatable ground.

Problems in Holding Company Regulation

In the first place, just how, under any proposed law, is a holding company to be defined? Is an insurance company or a trust company having large investments in utility securities to be deemed a holding company and regulated? Or is it to be deemed as being on a par with an individual having investments in utility securities? Is a corporation formed to handle the finances of an individual or family and investing in utility securities to be deemed a holding company and regulated, or not? If it is to be regulated, how and how much? These are extremes, to be sure, but it is an axiom that proposed regulation must be considered in the extreme of its application.

What of the company which is formed to purchase, hold, sell utility securities, which aids operating utilities in their financing, which issues its securities for public purchase, basing them on utility securities it owns? Is this company to be regulated, and if so, how? Is it required in the public interest to be supervised and regulated? Already such securities are carefully scrutinized under the so-called blue sky laws in 37 or 38 states, and must be approved in each state before they can be offered for sale there. And the operating companies, whose securities these holding companies own, are under some degree of supervision and regulation in the states where they are located.

What of the company which owns securities of operating utilities, issues its own securities against them to obtain funds to aid the operating companies in their financing, and which supplies special managerial, engineering, legal and other advice and services? This is the typical holding company as the public understands the term, the company which is supposed to be gobbling up operating utilities and swaying their destinies, though it may or may not have actual stock control of any one of them. Is this company to be regulated, and if so, how? It may have subsidiary companies in many states. Can any one of them exercise jurisdiction over it, or can all of them? To what degree may any one or all of these states assert jurisdiction, and will such assertion of jurisdiction be uniform or will it vary? Must federal legislation be resorted to? If so, will it interfere with existing state regulation or supersede it? What public benefits will result from transfer of regulation from state to federal jurisdiction? The securities of this holding company, please remember, will be scrutinized and approved under the blue sky laws. Its subsidiary companies will be subject to regulation which obtains in the various states in which they operate. Can more or better supervision be provided?

Must Participate in Solution of Problem

Whether or not it is necessary for the public interest to undertake regulation of holding companies, the doing of it would be far from easy. Yet the situation confronts our industry. It seems to me to be one which we should not shy away from. We should participate freely and frankly in any attempt to resolve these questions in the public's interest and in our own interest as an industry. For only thus will public understanding be gained and suspicion be abated.

Our industry can progress in future and develop to its maximum usefulness only as it possesses the confidence of the public. Our record in improving standards of service, in extending service to new customers and new territories, in reducing prices as efficiency and growth of business have permitted, has been impressive. That record, I am sure, will be continued. But as Owen D. Young so truly warned us a few years ago, the industry's progress must not be allowed to outstrip public understanding of it. No development in the economics of our business should be permitted to obscure our desire, our willingness and our intent to carry on in accordance with the public interest, and under such public control as a wise and informed public sentiment imposes on us.

New Design and Methods Require New Safety Technique

By C. R. Beardsley
Chairman N.E.L.A. Accident Prevention Committee

A REVIEW of the annual statistics which are submitted by member companies emphasizes the fact that education of employees to more careful performance of their work has been productive of improvement to a certain level of casualty ratio. Beyond this level there must be developed other means of improvement.

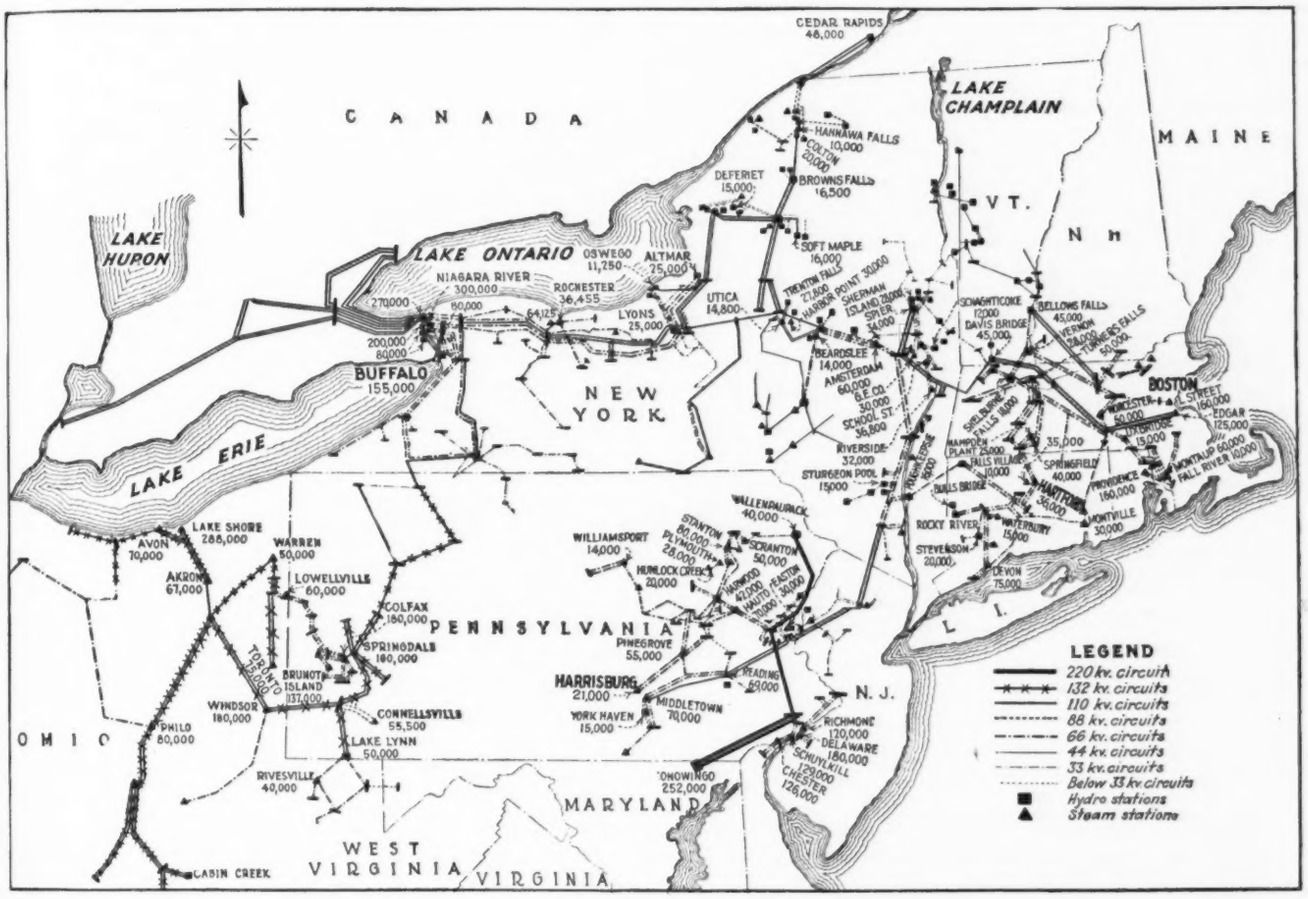
Routine training of employees has been developed to a well-established technique so far as their own performance in the handling of small tools and conduct while on duty is the controlling factor. There is the further necessity of development of new technique corresponding to new designs of equipment and operating methods. New designs of apparatus, complication of connections and increase in capacity of systems present new problems. Safe practices for earlier equipment designs are available.

To insure vigor of attack on the new problems and to vitalize the training of employees to the point of securing their enthusiastic interest it is essential that the chief executive of a company make known and continuously apparent his own vital interest in safety work and its results. Both reward and penalty, as they may be justly applied, are necessary to success. When this executive policy is apparent, each group head down the line reflects the attitude of the chief and the work becomes effective. Without such pressure from the top the work has sometimes tended to become perfunctory and listless.

The 1929-30 program of the accident prevention com-

Interconnected Systems

Which Regularly Operate for Mutual Advantage in the Northeast



Among the large systems which are involved in these interconnections are members of the New England Power Association, the Connecticut Valley Power Exchange, Niagara-Hudson Corporation, Philadelphia Electric Company, Pennsylvania Power & Light Company, West Penn Power Company, Duquesne Light Company, Cleveland Electric Illuminating Company and Ohio Public Service Company. Only the generating stations with a rating of 10,000 kw. or more are labeled.

mittee, as well as that of the recent preceding administrations, has been directed toward two main objectives: (1) To secure intense interest and hearty support of all executives and department heads and stimulate member company activity through Geographic Division organization and committee activity in other N.E.L.A. groups. It would be unjust to claim a lack of interest on the part of any executive or department head. It is quite true, however, that some are far more thoroughly interested than others, to the effect that their companies show decidedly lower accident rates. (2) To watch all trends of design which require new safe practice technique and secure distribution of the publications.

It is obvious that the national accident prevention committee is limited as to contacts and must work through and in co-operation with geographic divisions and other organizations. To this end a geographic division subcommittee has been formed and has prepared a manual of suggestions to geographic division accident prevention chairmen. A recent meeting with accident prevention men of other trade associations and with National Safety Council Public Utilities Section heads at Pittsburgh charted the way for effective co-operation and unified directed effort.

Profitable Foot-Candles

By M. Luckiesh

Director Research Laboratory, National Lamp Works, Cleveland

IN THE usual problems of engineering it is not difficult to determine when a proposition ceases to yield returns commensurate with the cost. In the case of lighting, with its many psycho-physiological factors, the maximum level of illumination fixed by the law of diminishing returns is not so readily determined. The problem is difficult because even in the simplest of visual tests there are many factors involved that cannot be eliminated, nor can they be ignored if the true effect of lighting on seeing is to be appreciated. Since industry has become exceedingly interested in lighting as a business proposition, it is necessary not only to supply data on the science of seeing, but also to insure its correct interpretation.

When a table of results from a test on the effect of lighting is lifted bodily from its accompanying discussion and interpretation and used as a sales argument the cause of higher-intensity lighting may suffer a handicap, since the story is but partially told. The accompanying

Foot-Candles	Relative Improvement in Speed of Vision	Speed of Reading	Visual Acuity	Accuracy of Vision	Average Result
1	46	68	72	93	70
5	100	100	100	100	100
10	125	108	108	103	111
15	145	111	110	104	118
20	153	113	112	105	121
30	153	114	113	107	122
40	153	114	114	108	122

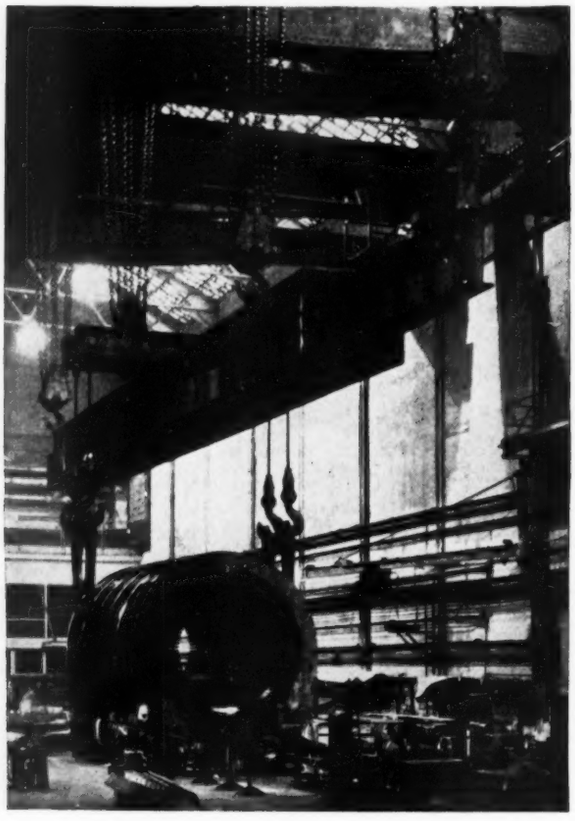
table summarizing the results from four representative visual tests illustrates the point.

If these data are used without further analysis, the erroneous conclusion might be reached that 20 foot-candles represented the maximum justifiable level of illumination. There are at least four reasons why this value is too low:

1. The experimental work (as is nearly always the case) was done with black objects on a white background. For ordinary reflection factors or contrasts the level of illumination would have to be increased several-fold for equal results.
2. The border line of vision is the only point at which seeing can be definitely measured, but this allows no "factor of safety." For clear seeing the illumination should be increased considerably to provide a reasonable factor of safety.
3. The subjects were free from disturbances of any kind during the experiment, and the eyes were thoroughly adapted to the intensity used. This is not true in every-day work and, therefore, higher intensities are necessary for the same results.
4. The data offer no accounting for reduction of eye strain for higher intensities.

The more justifiable conclusion from the data is that, for most cases where critical vision is required, 100 foot-candles may better represent the economic level of illumination.

Welded Beam Supports 200-Ton Load



This welded "double-tree" made it possible to distribute a 200-ton load among four 50-ton shop cranes and shows the faith placed in welded joints by the Westinghouse Electric & Manufacturing Company.

Long-Distance Motor Starting

By Charles Ewing
Operating Department, Louisville Gas & Electric Company, Louisville, Ky.

After the 2,500-hp., 13.2-kv. synchronous motor driving the 60,000,000-gal.-per-day pump of the Louisville (Ky.) Water Company (described in Electrical World March 23, 1929), had been in operation for a few months something went wrong with the automatic starting devices and the running switch failed to close.

As soon as the trouble was discovered it was found that the compensator had burned out. In order to prevent an interruption to the water supply the engineers began to warm up the steam pumps that had been superseded by the electrical installation. But a way to get the motor started was discovered when the operating department of the Louisville Gas & Electric Company was called into consultation.

The water company was the only customer on the line from the Waterside steam station of the electric utility. The bus section at Waterside that fed this line could be isolated. There was a 13.2-kv. station stand-by tie between Waterside and the Ohio River Falls hydro plant and this tie could feed into the isolated bus section. The tie could be fed from either of the double buses at the hydro plant. Why could not one of those buses be cleared, a connection established from it straight through to the 2,500-hp. motor and a hydro-generator put on it and brought up to speed. This was done. The proper switching arrangements were made and the hydro-generator, running free, was brought up to a terminal voltage of about 10,000. It was then closed on the bus. The motor started as an induction machine with, on account of line drop and generator regulation, about 7,500 volts at its terminals. Field current was then applied and the motor pulled into step with the generator, both operating at normal speed. The generator was then synchronized with the system. The bus and feeder switches were then returned to their regular positions. It took about ten days to get the compensator repaired and during this period the motor was started daily under this procedure from a point 6 miles away.

Incidentally, the initial failure of the compensator was traced to a mechanical failure of one of the oil circuit breakers. The mechanical device was repaired and in addition an interlocking relay added to the protective system which will function to trip out the supply circuit should this or other failure prevent the running breaker from closing in proper sequence.

2,000,000 Kw. Yearly

During the first seven months of 1929 the electric light and power industry added 1,150,000 kw. to the capacity of its generating plants, according to a statement issued by the statistical research department of the National Electric Light Association.

Of this total increase, 991,000 kw., or 86 per cent, was in steam turbines, 142,000 kw., or 12½ per cent, was in waterwheels and 17,000 kw., or 1½ per cent, was in internal combustion engines. At the present rate of construction approximately 2,000,000 kw. of new electric generating machinery will go into service during the present year, or substantially the same amount that was added in 1928.

Water Heater Characteristics

Analysis of domestic requirements for hot water reveal excellent load factor, power factor and diversity factor

By H. GEORGE D. NUTTING*
Sales Engineer
Detroit Edison Company, Detroit, Mich.

THIS paper, awarded the James H. McGraw second prize at the N.E.L.A. convention in June, emphasized the following aspects of the water-heating situation:

1. Electric water heaters are now practical and efficient. Several manufacturers offer them for sale at reasonable prices.
2. A 2-cent kilowatt-hour electric rate will get a large part of the available business and will heat water at less than the cost of heating it by city gas at $1.50 per thousand cubic feet.
3. High vs. low wattage. If the diversity factor for high-wattage heaters (5 kw.) is as good as 5 to 1 (which preliminary tests show), the same rate can be made for high-wattage heaters as for low-wattage (1 kw.) for uses of 10,000 gal. of hot water a year or more.
4. Off-peak water heating cannot be done as economically as "on-peak" if the fixed charges on the control and metering equipment and the "lost revenue increment" are included in the costs for off-peak service.
5. Water heater rates can be conveniently included in rate schedule forms now in force.
6. Electric water heaters should be merchandised by or under the control of the power company, and preferably by the power sales division at the start.
7. The electric water heater offers larger profitable revenue-building possibilities than any other appliance in sight at this time.
8. Strenuous efforts should be made to determine more definitely the diversity factor for high-wattage heaters, so that power companies can offer low rates, without fear of the future.

TO THOSE who are giving the subject much thought, the electric water heater is steadily forcing its way to the front as a revenue builder. Its appeal for serious consideration lies principally in the following points:

(1) The electric water heater has a load factor higher than any other residence load now existent. (2) It has practically unity power factor. (3) It furnishes a class of service that is a necessity in the home, hot water. (4) It has a favorable diversity factor. (5) It is safer, cleaner and more convenient than any other method of heating water. (6) It is as economical to install as any other convenient method of heating water. (7) It is reasonably economical to operate and compares favorably with other methods giving the same service. (8) It lends itself favorably to off-peak operation, if desirable.

Experience with hot water heaters shows that the greatest requirements in the home come on washday. On this day there is required the greatest quantity of hot water in the shortest space of time, i.e., the highest rate of flow or demand; also the highest temperature and the highest total quantity. Any water heater that satisfies the requirements of washday will usually easily satisfy the requirements of any other day. In the ordinary family 30 to 50 gal. of water at 160 deg. F., or higher, is needed to do the washing, and immediately after the washing is done there is likely to be at least one bath taken and sometimes two or three are taken. These are the conditions that make it difficult to use low-wattage type heaters, inasmuch as their recuperation is comparatively slow.

Large storage tanks can be used, but their heat losses, even when well insulated, are likely to be comparatively large. This condition is partially modified by the fact that a large tank can have a low-wattage element and therefore operate at a good load factor. Such a heater will automatically earn a low rate, so that, in the last analysis, while the wattage losses may be high, the money losses may not be excessive.

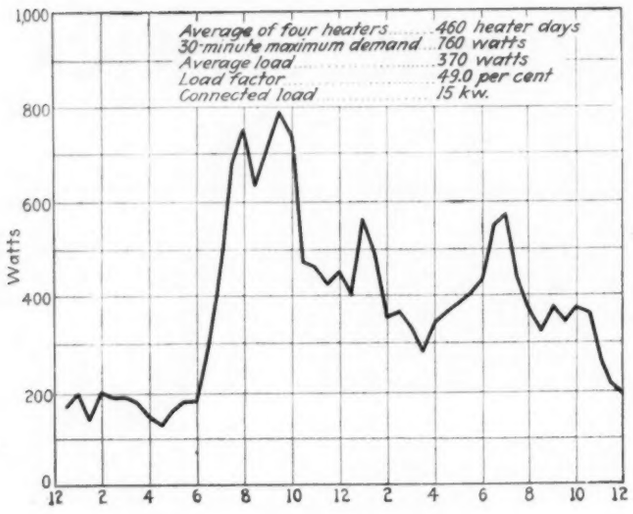
From the customer's standpoint the ideal electric heater would probably be a high-wattage instantaneous heater. To satisfy the demand for the speed of this day and age a heater would have to be able to deliver about 3 gal. a minute of 160 deg. water. Such a heater would be powered with 45 kw. A 15-kw heater would give quite satisfactory service, but even this would introduce necessities for heavy entrance switches, wires, meters, etc., which make its use appear undesirable at the present time.

It is therefore necessary to compromise and use either large storage tanks with small electrical elements or small storage tanks with large electrical elements. As between the two, the writer believes that the comparatively small tank with the large element will furnish the most satisfactory service to the customer, but at a higher monthly bill than the lower wattage heater.

For example, a 5-kw. element in an 18-gal. tank will give better service than a 1-kw. element in a 50-gal. tank. Also, at the same rate per kilowatt-hour, the 5-kw. heater will operate more economically, principally due to the lower heat losses through the insulation. The 5-kw. heater lends itself to manual or clock control and quick recuperation, thus making it unnecessary in many installations to maintain any high temperature water in storage. This affords an additional saving over the large storage type.

Space saving, quick recuperation, lower cost of tank replacements, savings by virtue of manual or clock con-

*Abstract of Mr. Nutting's paper, "The Electric Water Heater," awarded the James H. McGraw second prize at N.E.L.A. convention, June, 1929.



Average Daily Load Curve of Water Heaters
August, 1928, to January, 1929

trol also are in favor of the high-wattage, small-tank heater. Costs of replacing burned-out elements are against it. The low-wattage, large-storage tank heater lends itself better to off-peak operation, which, of course, does not apply to the high-wattage, small-storage tank type.

Water is drawn from kitchen faucets a greater number of times per day than from other fixtures. It is good practice, therefore, to install the heater as near as possible to the kitchen hot water faucet.

No general figures can be given which will show the cost of heating water electrically. Manifestly, the habits of use of the users control this. It may be said, however, that average homes use from 150 kw.-hr. to 500 kw.-hr. a month, with an average for summer use in the northern states around 200 to 400 kw.-hr.

Some electric heaters are connected in series or in parallel with range boilers attached to house heating plants and continue to use a certain number of kilowatt-hours all winter to supplement the heat furnished by the heating plant for hot water purposes. The range boiler also acts as a tempering tank in the summer time.

For those who like statistics, the following figures are offered showing the use of hot water:

1. Washing hands and face, shaving, etc., from ½ gal. to 3 gal. at a time at a temperature of about 110 deg. F.
2. Dishwashing, from 1½ gal. to 5 gal. at 120 to 130 deg.
3. Scrubbing, from 1 gal. to 5 gal. at 120 to 130 deg.
4. Bathing, from 10 gal. to 30 gal. at 105 deg.
5. Clothes washing from 15 gal. to 50 gal. at 160 deg.

These figures are very general, but will suffice to give some idea of the users' requirements. The average family will use in the vicinity of 6,000 to 10,000 gal. of hot water per year at 150 deg. F.

Competitive Costs

The question is often asked, "How does the cost of heating water electrically compare with the various competitive methods?" The answer is that none of these methods is really competitive. None can offer the three cardinal virtues of electricity, viz., safety, convenience and cleanliness.

For full automatic service, it has been found that city gas at $1.50 per 100 ft. is equivalent to electricity at 2½ cents per kilowatt-hour. This applies to automatic storage type heaters in both cases. The first cost of the gas heater will usually be less than that of the electric heater.

Some idea can be gained of a comparison of costs by inspection of the following calculations:

Assume a family of two adults and three children, and that the family averages three baths a day, three dishwashings a day, one clothes washing a week and the usual hand and face washing, shaving, etc. The monthly use of hot water will then be (based on cold water at 60 deg. F):

90 baths at 12 gal.	= 1,080 gal. at 100 deg.	= 360,000 B.t.u.
4 washings at 30 gal.	= 120 gal. at 160 deg.	= 100,000 B.t.u.
90 dishwashings at 2 gal.	= 180 gal. at 130 deg.	= 105,000 B.t.u.
300 hand and face washings at ½ gal.	= 150 gal. at 100 deg.	= 50,000 B.t.u.
Total above		615,000 B.t.u.

This will take $\frac{615,000}{3,412}$ = 180 kw.-hr. per month.

Add 25 kw.-hr. a month for tank losses (assuming a 5-kw., 18-gal. tank) and 25 kw.-hr. a month for pipe losses and the total monthly consumption of electricity will be 230 kw.-hr.

At 2½ cents per kilowatt-hour this will cost $5.17.

If gas were used to deliver the same service from a 30-gal. storage type automatic gas heater operating at 70 per cent combustion efficiency the figures would be:

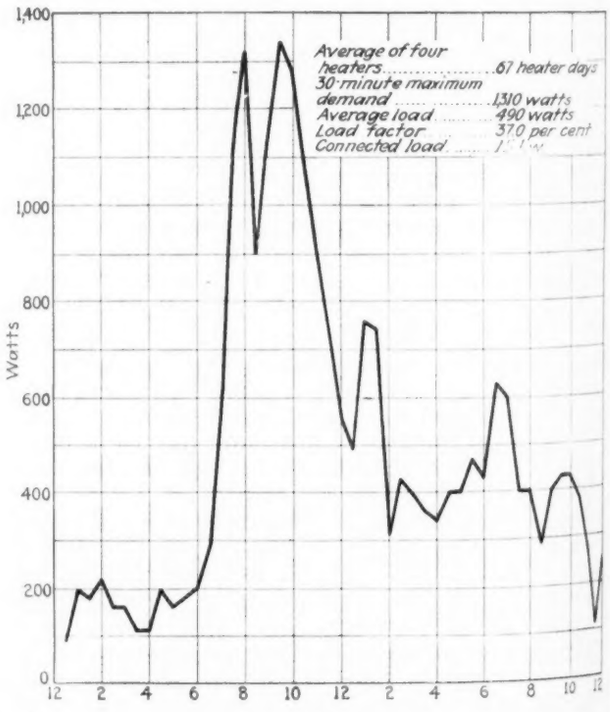
	B.t.u.
B.t.u. required in useful hot water	615,000
Losses in combustion efficiency	184,500
Losses in pipe lines	85,500
Total above	885,000

Assuming 500 (effective) B.t.u. gas,

Cu.ft. of gas = $\frac{885,000}{500}$ = 1,770 cu.ft.

Cost at $1.50 per 100 (net) = $2.76

The losses due to pilot flow and radiation in one type



Average Monday Load Curve of Water Heaters
August, 1928, to January, 1929

of automatic gas heater are said by gas engineers to be 2,000 cu.ft. per month. At $1.50 per 100 cu.ft. these losses would amount to $3 a month, making the total monthly cost of operation of the gas heater $5.76. If these figures are correct the gas heater costs more to operate (at a $1.50 rate) than the electric heater does for equivalent service at a 2½-cent rate.

In view of these figures, both of which are from reliable sources, it would appear that the cost of electric water heating compares favorably with the cost of gas water heating at rates ordinarily encountered.

Heater Requirements

An ideal electric water heater should have the following specifications:

1. It must be mechanically well built.
2. It must have an element that will not easily burn out or scale up.
3. The element must be easily removed for cleaning or replacement, preferably without turning off the water or disturbing the insulation.
4. It must be arranged so that scale and sludge can be conveniently removed from the tank and pipes.
5. It must have a reliable thermostat that will not get out of order for at least four or five years. The thermostat should be adjustable to operate at 120 or 160 deg., but it should not be differentially adjustable.
6. It must be thoroughly insulated with a non-inflammable material at least as good an insulator as 3 in. thickness of hair felt, and of a nature to prevent condensation on the outside of the tank.
7. It must be well finished on the outside of the insulation covering with a material that looks well and prevents rusting and corrosion.
8. It must be arranged so that it can be conveniently installed with manual or clock control.

Conclusion

The writer has attempted to place before those interested a compilation of theoretical and practical experience with electric water heaters. Within the range of his own experience the data offered are accurate. No attempt has been made to cover all of the ground, but rather to give the reader enough information to interest him in starting investigations of his own, to the end that the electric water heater may come into its own as a central-station revenue producer and as a service to the public.

The writer is indebted to Harry A. Snow, assistant controller of the Detroit Edison Company, and to Norman Wilcox, chairman of the N.E.L.A. water heating committee, for helpful suggestions. However, the writer's conclusions are not to be interpreted as their conclusions or those of their companies.

Further excerpts from the paper, dealing with the promotional and rate aspect of the electric water heater load, will appear in an early issue.

Transmission Lines Then and Now

ENGINEERS desiring to compare the present status of high-tension transmission with that prevailing about a decade ago might set beside the September 21 supplement an earlier one dated May 8, 1920. A very few copies of the latter are still available and will be sent on request, addressed to the Statistical Editor, as long as the supply holds out.

Letters from Our Readers

Favors Off-Peak House Heating

To the Editor of the Electrical World:

I note with interest the article in the September 21 issue of the Electrical World entitled, "Two Years with Electrically Heated Home." It seems logical to predict that the real economics of electric heating of residences is going to be on an off-peak basis with heat storage facilities, as has been done in various instances abroad with apparently considerable success.

It seems to me that it would be in order to suggest to the power companies of this country that they proceed on that basis rather than on the basis of direct electric heating as described in the article.

Sidney Withington,
Electrical Engineer.
New York, New Haven & Hartford Railroad Company,
New Haven, Conn.

Franklin Specification and Public Recognition of Lighting Needs

To the Editor of the Electrical World:

The editorial in the September 7 issue of the Electrical World anent the "Franklin Specification for Illumination Intensities" is timely and will remain so until the science of illumination is more thoroughly grasped both by the engineer and the educated layman generally.

The comparison made therein in respect to the definite requirements as to temperature and the disparity among the experts relative to lighting intensities gives adequate expression to prevailing conditions in this branch of engineering. It points the finger to the illuminating engineer and puts it up to him to improve matters to the end that the public will be as intelligently sensitive to its lighting needs as it now is to small temperature changes.

New York, N. Y. J. W. Herman.

Rates Alone Will Not Build Usage

To the Editor of the Electrical World:

I want to congratulate you on the sensible and well-expressed editorial on "Rate Reductions and Sales Increases" which appeared in the Electrical World August 31. Mr. Zuck's article in the same issue tends to encourage a belief that in order to increase revenue it is necessary only to reduce rates. This would be valuable to know if true, but is a terribly dangerous doctrine if untrue. It is vigorously preached by divers self-appointed representatives of the people, who will welcome any apparent confirmation of their assertions that the electric companies not only oppress the consumers but actually stand in their own light.

Data are comparatively easy to collect but usually hard to interpret, and it is particularly difficult when considering statistics over a period of years to determine how much effect any one factor has had upon the combined result. I have several times encountered among operating executives the belief that their own experience shows that decreases in top rates are immediately compensated by increased use. Invariably in such instances it has been possible to show that what they "got back" was only the normal increase in use due to

changing conditions and better education, and that a critical analysis could discover little, if any, effect upon consumption due to the rate change. It frequently happens also that increased consumption makes possible a rate reduction and, in a study of comparative figures at the beginning and end of a period, the result can easily be mistaken for the cause.

If we make the moderate assumption that in the five years from 1924 to 1928 the average use would have increased 25 per cent without any rate changes, the gross revenue would have increased correspondingly and in 1928 we would have had 25 per cent increase in gross with only 25 per cent increase in output. The greatest group revenue increase shown by Mr. Zuck's data is 17.74 per cent, in obtaining which it was necessary to manufacture and deliver 60.43 per cent more kilowatt-hours. Rate reductions may be justified, and when proper they should be made, but it is important that no misapprehension should exist as to the probable results, in which the net revenue is of more importance than the gross.

I believe that consumption is influenced much more by education and sales effort than by rates. Suitable rates are, of course, a valuable adjunct to sales effort, and when it comes to rates you have hit the nail exactly in saying that the form of rate is the important thing. Reductions in the top rates of block schedules are of little help to the salesman, but he is greatly assisted by a properly constructed inducement rate which permits him to show the customer that the use of additional appliances entails a very low rate per kilowatt-hour for the additional energy consumed.

New York City. EDWARD J. CHENEY.

Search Old Inventions for New Ideas

To the Editor of the ELECTRICAL WORLD:

I read with great interest Prof. Elihu Thomson's letter in the September 21 issue of the ELECTRICAL WORLD, in which he brings out the fact that the basic idea of the compressed air breaker which was mentioned in your recent editorial as having been used in Germany lately with some success was patented by him as far back as 1882 and 1883. Professor Thomson will no doubt be generous enough to forgive you for overlooking his patents.

But the fact brought out by him induces me to make a suggestion. Such practical inventors as Professor Thomson are generally ahead of their time. The fact that something was not previously known, that it had to be invented, is almost sufficient proof that the inventor is ahead of his time. Inventors and scientists of Professor Thomson's caliber have invented many things and suggested many ideas which have not yet been used in practice because the industry does not follow along with the speed of their brains. Or the ideas have been used in certain fields without any one taking the trouble to investigate the possibility of applying the same ideas in other fields.

It might be profitable for some organization to make a systematic search of such old patents and ideas, especially of such great and fertile minds as Professor Thomson's. It may find that we have now advanced far enough, caught up with the inventors, and may find some simple solutions to some difficult problems which now actually confront us. M. M. SAMUELS.

J. G. White Engineering Corporation,
New York City.

Electric Galvanizing Costs 100 Times Too High

To the Editor of the ELECTRICAL WORLD:

Although the relative costs of electric galvanizing as compared with fuel-fired tanks, as published in an article in the August 24 issue of the ELECTRICAL WORLD, page 375, were correct, unfortunately there was an error in the costs per pound as given. That part of the article referring to economies should have read, "At a rate of 1¼ cents per kilowatt-hour this amounts to 0.144 cent per pound of work galvanized. Previous tests with a gas-fired tank showed an average cost as high as 0.275 cent per pound, indicating an actual fuel saving of 0.131 cent per pound with the electric tank." That is to say, that in the costs given in the article the decimal point should be moved two places to the left to be correct.

RICHARD E. SMITH,
Advertising Manager.

Southern California Edison Company,
Los Angeles, Calif.

Should Something Be Done for the Meterman?

To the Editor of the ELECTRICAL WORLD:

In a letter to the editor of the ELECTRICAL WORLD, issue of July 23, 1927, page 168, occurs the following statement: "I turn to the May 15, 1927, Harvard Business Alumni Association Bulletin, page 144, last table, entitled 'General Averages,' and find that public utility employees stand particularly the lowest on the list of all industries, including even teaching, in rates of compensation to employees." Since then considerable investigation and fact finding have disclosed that this statement has some foundation in truth, and particularly so when the electric meter departments of our central station public utilities are examined. As my purpose is constructive and helpful only, I merely wish to state the facts, as I have been able to obtain them, and to suggest a remedy for this negative condition in "our magnificent industry," of which, with all its faults, of youth and of rapid growth, we may well be proud.

To be definite, I submit the following "composite" wage scale, which I claim to be fairly representative of the larger type of central station meter department:

	Cents per Hour
3 "Big meter" testers	80 to 90
30 Inspectors and meter testers	50 to 75
20 Installers and collectors	50 to 75
30 Meter readers	40 to 70
15 Meter repairmen and helpers	30 to 60

Total 98 technical men. Average wage is 62 cents per hour, eight hours per day, 300 days per year—$1,488 yearly wage.

A department of this size requires about 25 clerical workers, which will bring the average wage to a somewhat lower figure. Most of these men are married, and family needs require a full compensation. That it has taken an outside party to reveal this condition to us should move us to at once investigate and remedy any defect or limitation of organization or policy that may be found to interfere with the most modern practice.

Therefore I respectfully suggest that the meter committee of the N.E.L.A. take up the matter of this aforementioned statement, to determine the truth of it, and to recommend such changes as may be necessary to put, at least, the American electric meter department beyond any such criticism. ROGER S. WHITE.

Washington, D. C.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

West Kootenay Completes No. 3 Plant.—The third project in a comprehensive scheme for the development of the Kootenay River in British Columbia has been completed with the placing in operation of three 17,500-kva. hydro-electric units. The development is of particular interest both because of some of the unusual practices incorporated in the civil engineering of the job and because of some of the electrical designs. The oiling system is supplied from a main and auxiliary system, in addition to which a gravity supply is provided. The cooling air used is all washed before admission to the generator cooling ducts. A 70-ft. head is used. Each generator has its own bank of transformers, consisting of three 6,000-kva., single-phase units, 6,600 to 60,000 volt transformation.—*Electrical News and Engineering (Canada)*, September 15, 1929.

Generation, Control, Switching and Protection

Recent Developments in Turbo-Generators.—J. A. KUYSER.—An endeavor to indicate the limitations involved in the development and utilization of large size turbo-generator units, to enumerate some of the difficulties encountered in actual service and to show the means used to avoid them in later designs. Among the topics covered are ventilation, elimination of eddy currents in windings, magnetic field of stator end connections, coil retaining rings, and similar elements. As a result of field experience, it is concluded that in general large turbo-generator units are satisfactory, since the rate at which progress has been made in the size of units has not been so rapid as to give rise to serious difficulties. Considerable further increase can be anticipated in the maximum size of units which can be built for 3,000 r.p.m. design. A desirable size at present is given as 50,000 or 60,000 kva., a unit of double this output capacity being anticipated in the near future. This is said to depend upon the progress made in rotor forgings and upon the maximum safe journal dimensions.—*Journal of the Institution of Electrical Engineers (England)*, September, 1929.

Alternator Protection.—ARTHUR A. F. GILES.—The author has enumerated the fundamental qualities required of any protective system as: Sensitivity, stability, reliability and discrimination. In connection with his analysis of the requirements for adequate protection a number of elements have been reviewed and principles indicated, including protection against overload, reversed power, insulation faults, failure of field excitation, failure of the prime mover and short circuits. The author has not endeavored to point out the overwhelming superiorities of any one system, but has confined his efforts to a critical examination of those now in use.—*Electrical Review (England)*, September 6, 1929.

Transmission, Substations and Distribution

Transmission of Large Energies.—M. L. KELLER.—The author presents an exceedingly elaborate paper on the theory of large power transmission. The first part, which is highly mathematical, covers, the calculation and the stability of systems, using in many cases a novel graphical vector method and circle diagrams. Synchronous condensers and transformer load ratio control are considered as essential adjuncts to a satisfactory operation of long transmission lines. In the second part an application of the author's theoretical considerations is shown in a detailed description of the Conowingo-Philadelphia 220-kv. system. A complete bibliography of the subject matter, with 67 citations covering the period of the last eighteen years, has been included.—*Bulletin de l'Association Suisse des Electriciens*, August 7 and 22, 1929.

Interconnections Between Secondaries of Supply Transformers.—P. WITTICH.—To insure uninterrupted service in city systems, a heavy interconnection between feeding centers has been customary on direct-current supplies. Similar considerations had to be given to alternating-current distribution systems, where the secondaries of block transformers are to be interconnected, so as to maintain service even if one transformer should fail. The author has investigated the comparative advantages of various methods of tying from the standpoint of regulation, losses in the connections and maximum short-circuit current. Apparently the excess load on the nearby transformers in case of fault in one of them is well within their permissible heating capacity, while the I^2R losses in underground cables may reach excess values of between 33 to 100 per cent and may therefore have to be considered. If possible, each side of the street should have its own supply cable, avoiding cross-street connections. Interconnections on all four sides of each transformer, with a double cable system for the two sides of each street, give best regulation at the customer's meter, least overloads in the cables, but slightly larger short-circuit currents at transformers.—*Elektrotechnische Zeitschrift*, August 29, 1929.

Units, Measurements and Instruments

A Portable Radio Intensity-Measuring Apparatus for High Frequencies.—J. HOLLINGWORTH and R. NAISMITH.—A high-frequency radio apparatus, capable of measuring in absolute units the intensity of the electromagnetic field over the frequency band of 5 to 12 megacycles per second, has been devised by the authors. This set is easily portable, since the total weight without batteries is only 60 lb. An untuned antenna, which is coupled to the grid of the detector tube in an unusual manner, is used to pick up the energy to be measured. Sensitivity is not seriously affected since the range of intensities which can be measured is from 10 microvolts per meter to 10,000 microvolts per meter. The screening difficulty is lessened by using a resistance attenuator and toroidal inductances, and by totally disconnecting the aërial during calibration. The set consists essentially of a detector tube which is associated with a control tube. One stage of audio-frequency amplification follows the detector and a diode used as a second detector allows a galvanometer to be used for the signal comparison. The complete apparatus has been subjected to a series of tests in self-consistency and absolute value.—*Journal of the Institution of Electrical Engineers (England)*, August, 1929.

Telegraphy, Telephony, Radio and Signals

Power Supply for German Telephone and Telegraph Centrals.—X. STUBER.—The formerly exclusive use of wet primary cells for the power supply of telephone and telegraph current has now been entirely supplanted by more economic and more reliable sources, such as lead type storage batteries, motor-generators and rectifiers. Manually operated exchanges, requiring 24 volts direct current, have either two sets of batteries, one discharging while the other is being charged, or lately one battery floating at 70 per cent fully loaded condition on a machine-generated supply. To avoid commutating ripples, many-section commutators, wide brushes and a generous air gap are required on such machines. Dial exchanges require 60-volt and 450-cycle alternating current for the busy signal. Both exchanges need also 25 to 115-cycle alternating current for bell ringing. Small motor-generators are in common use, supplying both frequencies (115 and 450) from one specially designed armature. Rectifiers of the mercury-vapor glass bulb type and of the sodium-potassium valve tube are in extensive use. In repeater and radio stations filament heating batteries and anode potential generators are needed. Tests are being made lately to attempt heating of large tubes directly with high-frequency current. — *Elektrotechnische Zeitschrift*, August 29, 1929.

News of the Industry

Trade Practices Featured by N.E.M.A.

Manufacturers Discuss Market Development, Policies and Standards at Washington Convention—Sections Represented at Conference Conducted by Federal Trade Commission

MEETING at Washington this week from Monday to Friday for its third annual convention, the National Electrical Manufacturers' Association was told by President H. B. Crouse that the big problems before this branch of the industry are to consolidate and make effective the present organization, to develop markets and to accomplish effective co-operation with other branches of the electrical fraternity.

W. W. Freeman, president of the Society for Electrical Development, recited instances of the work of that body and indicated tangible results in the accomplishment of adequate wiring, uniform ordinances and other desirable ends. W. E. Sprackling spoke on market development and urged the members to co-operate in the program developed by the Industry Sales Conference. Thomas Allen outlined the present status of the tariff situation.

The numerous sections of the N.E.M.A. met during the week for discussion of technical problems, standardization, ratings and trade practices. A very interesting innovation was to be a conference of representatives from eight of the sections with the Federal Trade Commission on Friday. The sections to be represented were those concerned with molded products, manufactured electrical mica, outlet boxes and conduit fittings, flexible cord, panelboard and distribution board, carbon brushes, vulcanized fiber and carbon arc lamps. The general procedure arranged for was that of a conference on trade practices wherein it was desired that the Federal Trade Commission would rule what was permissible and what was not permissible under the anti-trust laws. It was expected that the commission would take some time in replying to the briefs of the sections.

The members of the association learned with regret that Alfred E. Waller had resigned as managing director, and resolutions were passed by the board of directors to this effect. President H. B. Crouse announced that A. W. Berresford had been appointed as the new managing director.

At the meeting of the board of governors the following officers were elected for the year 1929-30: President, Clarence L. Collens, Reliance Electric & Engineering Company, Cleveland; vice-presidents (in order of seniority determined by law), S. L. Nicholson, Westinghouse Electric & Manufacturing Company, New York; C. H. Strawbridge, Goodman Manufacturing Company, Chicago; W. E. Sprackling, Anaconda Wire & Cable Company, New York; D. R. Bullen, General Electric Company, Schenectady; L. B. F. Raycroft, Electric Storage Battery Company, Philadelphia. These men, with

Clarence L. Collens

George W. Mason of Detroit, H. B. Crouse of Syracuse, F. R. Fishback of Cleveland, I. A. Bennett of Pittsburgh, H. T. Bussman of St. Louis, Paul G. Duryea of Trenton, H. J. Mauger of Chicago and D. H. Murphy of Hartford will compose the executive committee. R. H. Goodwillie, Otis Elevator Company, Yonkers, N. Y., will be treasurer.

Mississippi to Have Utility Investigation of Its Own

Members of a joint legislative committee to make a study of public utilities in Mississippi have just been appointed and will begin their inquiry at once. Their report will be submitted to the regular session of the Legislature in 1930.

Representative C. C. Pace, author of a concurrent resolution to appoint such a committee, mentions the following subjects as needing investigation: Sale of the Inland Utility Company, embracing a number of central Mississippi plants, to a competing company; sale of eastern Mississippi properties by the Mississippi Power Company to the Mississippi Power & Light Company; territory agreements, issuance of preferred stock, floating of large bond issues, a conservative approximate valuation of lighting plants purchased and then bonded, and an analysis of rates in Mississippi as compared with those of surrounding states.

Inquiry Into New York's Commission Law Opens

Chairman Prendergast Points to Defects in Its Operation and Explains the Trading Principle in Fixing Rates—Dean Mosher's Work

PUBLIC hearings by the legislative commission appointed to investigate the New York State Public Service Commission law and its administration opened in New York City on Wednesday of this week with an examination of Chairman William A. Prendergast of the commission by William J. Donovan, counsel for the investigating body.

In response to the questions of Mr. Donovan and members of the investigating body Commissioner Prendergast explained that the commission (1) can of its own initiative institute proceedings for a hearing regarding rates but cannot initiate rates, (2) has not the facilities in either personnel or appropriations to do the work it was created to do, (3) should have jurisdiction over bus, submetering, air transport and private water companies, and (4) should have as members specialists in certain regulatory activities. Staff hearings, without a commissioner, similar to those held by the Interstate Commerce Commission, would, Mr. Prendergast suggested, relieve commissioners of detail work.

Of particular interest was the conceding by Commissioner Prendergast that rate reductions were to a great extent matters of negotiation and trading. He viewed it as desirable to work upon the basis that it was proper in principle to obtain such reductions as might be readily brought about, although not necessarily the best that might be had through protracted negotiations which in the interim would preclude any immediate reductions, rather than to prolong matters unduly; in other words, to establish the principle of frequent and continued reductions rather than to delay savings to the public. The fact that bases of valuation suitable for further negotiations were not established in rate changes secured on the trading principle was also brought out.

The financial barrier which precludes

extended and detailed inventories or appraisals by the commission was the closing topic at this hearing before it was adjourned to the following day. Professor James C. Bonbright, one of the investigators, contended that the commission had the statutory right but not the funds to examine, while the cities which sometimes desired to act had the funds but not the legal right to make such examinations. Mr. Donovan was of the opinion that the Legislature creating the Public Service Commission probably intended such examinations, inventories or appraisals to be made by the commission and that they should be made by it. Commissioner Prendergast pointed out that special appropriations had been made for certain cases.

When the testimony of Mr. Prendergast is finished the other commissioners will follow him on the stand. Following them, representatives of the utility groups will be heard, and then will come opportunity for others to submit their views.

The investigating commission has had the services of Dean Mosher, of the Syracuse University School of Citizenship and Public Affairs, to aid it in its research work. With a corps of assistants he has been examining into every phase of the public service commission law of this and other states. The investigating commission announces that it is preparing to examine very thoroughly (1) the operation of the law, (2) the form of administration and its efficiency, (3) proposed amendments to the law, including one to increase the jurisdiction of the commission over holding companies and mergers.

The investigating commission is composed of Senator John Knight, chairman, and Senators Warren T. Thayer and William J. Hickey; Speaker Joseph A. McGinnies, Majority Leader Russell G. Dunmore and Horace M. Stone, representing the Assembly; Frank S. Walsh of New York City, Prof. James C. Bonbright of Columbia University, and David G. Adie of Buffalo, the last three appointees of the Governor.

Northern States Power Slashes Its Rates Again

Voluntary rate reductions amounting to $1,250,000 a year, on the basis of present consumption, and effective on bills rendered after December 1, were announced October 7 by the Northern States Power Company. About 75 per cent of the reduction will go to the four hundred towns and smaller cities served by the company in the North Middle States and the rest to users of comercial lighting and of power in Minneapolis and St. Paul.

With the new adjustment the Northern States Power Company has reduced its charges for electricity in Minnesota, Wisconsin and the Dakotas by $2,465,000 in less than two years, according to Robert F. Pack, vice-president and general manager. A year ago the corporation cut its retail rates more than a million dollars, virtually all of this reduction applying to the Twin Cities. The new rates will benefit residential, commercial and industrial consumers in the smaller communities.

Residential Rates Lowered in South Georgia Cities

Residential light and power rates were revised and made uniform in 27 Georgia cities and towns in an order issued last week by the Georgia Public Service Commission. The commission put the customers of the South Georgia Power Company of Albany and the Columbus Electric & Power Company of Columbus on the same rate basis as was recently fixed for customers of the Georgia Power Company.

The new rates are 5 cents per kilowatt-hour for the first 50 kw.-hr. a month, 3 cents for more than 50 kw.-hr. and less than 200 kw.-hr., and 2 cents for more than 200 kw.-hr. There will be a service charge of $1 and a 10 per cent deduction for prompt payment. A delay has been granted by the commission in the case of the Columbus company.

Electricity, Not Subsidy, Is Farmer's Need

So Wisconsin Agriculturist Tells Delegates at Fond du Lac Commercial Meeting — Appliance Merchandising by Utilities Declared Right Policy

PRACTICAL application of electricity to agriculture affords more farm relief than government subsidies, William H. Kuntz, Merton, Wis., told the Commercial Section of the Wisconsin Utilities Association, in session at Fond du Lac on October 3 and 4, with an attendance of 180. Farmers have no interest in political "rackets," such as government ownership, that will retard legitimate electrical development, said Mr. Kuntz, who farms near Merton.

G. W. Van Derzee, Milwaukee, president of the Wisconsin Utilities Association, told the convention that greater individual use of electric and gas service offers more opportunity for future rate reductions than is now known to be possible through any improvements in efficiency of operation. Opportunity for intensive development of the use of utility service through improved merchandising efforts is tremendous, he said. Utilities should be active merchandisers of appliances at all times, Colonel George Washington Hill, of Newton, Iowa, asserted.

Other speakers on the program were Otto Naegli, Milwaukee; F. W. Bond, Chicago; Miss Marie Sellers, New York, and F. W. Huels, Madison, who all addressed themselves to practical considerations in the furtherance of sales.

F. H. Evans of the Wisconsin Valley Electric Company of Wausau was elected chairman of the section, succeeding E. R. Felber of Madison. E. L. Brunsman, Jr., of the Wisconsin Power & Light Company, Madison, was elected vice-chairman.

Purchases and Mergers

Pacific Gas & Electric Buys Vallejo Company Stock—American Power & Light Reported to Be Buying Commonwealth Utilities Corporation

APPLICATION has been made by the Pacific Gas & Electric Company to the California Railroad Commission for permission to acquire 4,583⅓ out of 10,000 shares of the common capital stock of the Vallejo Electric Light & Power Company in exchange for its own stock. Presumably this means a working control for the purchaser, which already supplies the Vallejo utility with its energy for resale. The Vallejo shares have a par value of $10.

It is reported that the American Power & Light Company will purchase the Commonwealth Utilities Corporation of St. Louis. The latter, with assets of $17,564,000, is a holding company for utilities serving 53 communities in eight states. These utilities include the Arizona Power Company, the Prescott (Ariz.) Gas & Electric Company and the Columbus, Delaware & Marion Electric Company of Ohio.

What Nashville (Tenn.) newspapers called "well-authenticated reports" to the effect that the Tennessee Electric Power Company had just completed negotiations whereby it had acquired the Southern Cities Power Company were borne out this week at proceedings before the state commission. The Southern Cities Power Company serves about forty communities in Tennessee and a few in Alabama. These properties have been known as "Whetstone holdings," Walter A. Whetstone of Philadelphia being president of the company.

The Empire Public Service Corporation has filed application with the Maryland Public Service Commission for permission to acquire the Suburban Electric Power Company by stock purchase.

The Southern Public Utilities Company, subsidiary of the Duke Power Company, has purchased the holdings of the Brevard Light & Power Company and the distribution lines of the Cascade Power Company. Both of the purchased concerns belonged largely to the R. J. Pickelsimer estate.

A special election will be held at Cartersville, Ga., on October 15 to determine whether or not to sell the municipal electric plant and franchise to the Georgia Power Company for $460,000. The company has pledged itself, if its offer is accepted, to build a 60,000-hp. plant on the Etowah River.

The Alabama Power Company has asked the state utility board to approve its purchase of electric plants at Hanceville, Steppville and Garden City, Ala., from the Municipal Water & Light Company.

A petition is being circulated in Thibodaux, La., for the calling of an election upon a proposal of the Louisiana Public Service Company to purchase the local power and light plant.

Purchase of the electric property of the Richwood Light & Water Company by the Monongahela-West Penn Service Company has been announced at the latter company's offices in Fairmont, W. Va.

Bayport (Minn.) voters, for the third time in a year, on September 30, at a special election, defeated a proposal to sell the electric light distribution system in the village. The vote was 284 for the sale

and 188 against, lacking the necessary two-thirds majority. The Northern States Power Company again made an offer to purchase the system for $60,000.

The Interstate Public Service Company of Indianapolis has been authorized to purchase nine rural light and power lines owned by co-operative interests near Bremen. The Indiana commission also gave the Hope Light & Power Company permission to buy the distribution system at Flat Rock for $13,500, and the Otterbein Light & Power Company was granted permission to sell its property to the Interstate Public Service Company for $49,000.

The Cambridge Gas Light Company has requested authority from the Massachusetts State Department of Public Utilities to take over the Cambridge Electric Light Company. Both are controlled by the New England Gas & Electric Association, affiliate of Associated Gas & Electric.

Answering the complaint of would-be consumers of electricity (ELECTRICAL WORLD for October 5, page 705), the Potomac Edison Company has declared its willingness to extend its lines to serve them if the Maryland Public Service will grant it permission to purchase the Damascus Electric Company, now in the territory concerned.

Jubilee Preparations Continent-Wide

Celebration Gives Keynote to New York's Exposition, Illumines American Legion Convention at Louisville and Is a Public Theme in Cities All Over Nation

WHEN the National Electrical Exposition was opened in the Grand Central Palace, New York City, on Monday, Vice-President Curtis at Washington pressing the official button, Charles Edison, son of the inventor, lighted a replica of Edison's first lamp. Mayor Walker then spoke briefly, asserting that Edison's inventions "have brought about an entirely new world." A huge display, consisting of a quadruple arch bedecked with 10,000 golden electric light bulbs, featuring "Light's Golden Jubilee," was installed near the entrance to the exposition floor. To one side of it was a replica of Edison's original laboratory at Menlo Park, N. J., where the incandescent lamp was born.

"Light's Golden Jubilee" was celebrated in Louisville on September 30, simultaneously with the opening of the American Legion's eleventh annual convention. The night was designated as Edison Night, and the electrical fraternity co-operated in making the celebration one of the most brilliant and spectacular electrical displays in the history of the city. Nearly 11,000 gold-colored lamps were used.

At Kansas City the center of attraction will be on Eleventh Street, between Main and Grand. About 30 ft. above the street will be a continuous golden ceiling produced by electric light, and at the intersection of Eleventh and Walnut there will be a revolving ball radiating streams of varying light. This special illumination will begin on October 12 and last over October 21.

In Detroit jets of water in a commemorative fountain at Grand Circus Park, erected by the city in honor of Mr. Edison, will play for the first time on October 18. Color effects will change automatically at five-second intervals. The Detroit Edison Company has arranged an elaborate program. Floodlighting will make the stacks of the Connors Creek plant visible for miles around.

Port Huron is marking the site of Mr. Edison's former home in what is now Pine Grove Park with a 42-ton stone in which is set a bronze plaque.

"Light's Golden Jubilee" will be celebrated by the Cleveland Club, Cleveland, at a luncheon meeting at Wade Park Manor October 15. Overhead will be replicas of the original Edison lamp of 1879. Special guests will include representatives of 50 electric concerns.

The City Council of Pittsburgh and the Commissioners of Allegheny County, Pa., have made a joint appropriation of $65,000 for the celebration of the jubilee there. One feature will be the erection of six United States Navy searchlamps, each to be installed on the roof of a high building. These will illuminate a large part of the business section. Pageants October 22 and 23 are expected to bring thousands of visitors to the city.

Former Mayor W. R. Stone heads a Chamber of Commerce committee at Syracuse, N. Y., which is sponsoring the celebration in that city. The program includes college football games played at night by the light from floodlamps. One of these has already taken place and attracted much enthusiasm. On October 24 a pageant in which four thousand children will take part is to be held at the stadium.

Governor Allen of Massachusetts has authorized the floodlighting of the Massachusetts State House at Boston, and the Boston Public Library in Copley Square will also be illuminated in this fashion on October 21. Ornamental street lighting in the Back Bay district of Boston will usher in the Edison celebration, and airplane and searchlight effects are being planned. All of the companies under the management of Charles H. Tenney & Company will participate in the jubilee with special window displays.

Governor Trumbull of Connecticut has appointed a committee to further the celebration, concerning which he gave out a statement asking for general public participation. Samuel Ferguson, president Hartford Electric Light Company; Alfred W. Daker, president Stamford Gas & Electric Company; C. E. Paterson, General Electric Company, Bridgeport; F. C. Ross, General Electric Company, New Haven (secretary), and many other electrical men are members of the committee, of which the Governor is honorary chairman.

At Hartford, Conn., there will be spectacular floodlighting of the Municipal Building, the Wadsworth Atheneum and the Hartford Times Building.

A statewide committee of sixty has been named by Governor Larson of New Jersey to draft suitable resolutions for presentation on behalf of that state to Thomas A. Edison in connection with the anniversary celebration. Thomas N. McCarter, president Public Service Electric & Gas Company, is the chairman.

Baltimore is already substituting light of a golden hue for the ordinary color on a number of downtown thoroughfares.

A horizontal cross of golden light will be the outstanding feature of Atlanta's celebration. It will extend from Baker Street on the north to Mitchell Street on the south, along Peachtree and Whitehall Streets and equilaterally along Decatur and Marietta Streets, while at Five Points there will be a great central display composed of hundreds of 25-watt lamps.

The illumination program to be carried out at the Texas State Fair at Dallas is the most elaborate ever projected in the Southwest. The plan contemplates the use of about 50,000 lamps in gold, pearl, ruby, emerald and sapphire colors, constituting a "grove of jewels," over which will shine a 50,000-watt lamp built especially for the celebration. This is declared to be the largest single lamp ever made.

Participation of the city of Portland, Ore., in the celebration will take the form of an electrical display on Portland's new waterfront development, the central feature of which will be an electrically illuminated fountain in a setting of lawn and shrubbery. Night flying of illuminated planes also will be a feature of the display. The spectacle will be ready on October 21 and kept lighted nightly thereafter for two or three weeks. Plans were prepared by the Portland Electric Club, of which F. H. Murphy is president. A sponsoring committee containing the names of many prominent citizens is headed by the Mayor.

Similar preparations are being made in scores of other American cities, while echoes of the enthusiasm are heard across the ocean and from South America.

Special illumination displays, radio programs and a reception attended by President Washington Luis will be held in honor of the inventor at Rio de Janeiro, Brazil. The younger generation will be told about his achievements in lectures delivered in the public schools.

Milan, Italy, will celebrate the anniversary from October 21 to 28. Acting Commercial Attaché A. A. Osborne, Rome, informs the Department of Commerce. All business houses will be asked to illuminate their premises during the entire week, and a first prize of $526 for the best business illumination is offered by the Società Edison.

Trade Commission Drops "Propaganda Phase"

Hearings Will Now Wait on Recovery of Counsel—Clapp Repeats Denial of Knowledge About Origin of Anonymous Document

AT THE conclusion of the hearing in the Federal Trade Commission's utility investigation held on October 3 and briefly reported last week (page 701), Chairman McCulloch announced that inquiries into the so-called propaganda activities of public utility associations were closed, though this phase of the investigation might figure further in the examination of different companies. Hearings would be again suspended, he stated, because of the illness of Judge Robert E. Healy, chief counsel of the commission, and it might be several weeks before they were resumed. When the hearings are resumed public utility associations and companies will have an opportunity to present their side of the "propaganda phase."

Besides Paul A. Schoellkopf, president Niagara Falls Power Company, and M. O. Leighton of Washington, who, as reported last week, took the stand to deny all knowledge of the origin of the so-called "mysterious memorandum" which criticised accounting practices of the Federal Power Committee and suggested somewhat devious ways in which the light and power industry might bring about a change, Paul S. Clapp, managing director of the National Electric Light Association, made a similar denial.

Mr. Clapp was called to the stand at the suggestion of Bernard F. Weadock, special counsel for the Joint Committee of National Utility Associations. The memorandum had been given to several Washington newspaper correspondents, Mr. Clapp said, by Laurence Todd, correspondent of the Federated Press, listed in the Congressional Directory as the "telegraph agency of the Soviet Union." After it was published Mr. Clapp tried to discover its authorship but without success. The documents, he added, did not represent the sentiments, opinions or ideas of utility men. Mr. Todd was present at the hearing but was not called as a witness. Mr. Clapp read into the record the statement issued by him when the origin of the memorandum was first discussed. This statement was printed in the ELECTRICAL WORLD for August 10 (page 290).

Reasons put forth for calling Mr. Schoellkopf and Mr. Leighton were that Mr. Schoellkopf is a member and former chairman of the water-power development committee of the N.E.L.A., and that Mr. Leighton had represented several clients before the Federal Power Commission.

Rushing the Saluda River Dam to Completion

RAPID progress on the Lexington Water Power Company's great earthen dam on the Saluda River near Columbia, S. C., is being made. Work goes on day and night six days a week, and recently the Arundel Corporation of Baltimore, sub-contractors, moved 701,217 cu.yd. of earth into the dam in a single month. At a recent date over 6,000,000 cu.yd. had been moved. When completed the dam will contain 11,000,000 cu.yd.

The foundation and working bay for the first unit of the power station is complete, and much progress has been made on the erection of the structural steel for the Tainter gate supports for the spillway. The spillway overflow will be controlled by four gates. Each will be 25 ft. high and 37½ ft. wide, giving a total clear opening of 150 ft. The station will have an initial capacity of approximately 176,000 hp. It will be built of concrete, steel and brick and will be 58 ft. wide, 250 ft. long and 95 ft. high.

Fuels Meeting Takes Up Many Plant Problems

Photo-Electric Smoke Recorder Described—Stokers and Water Walls and Ridding Furnaces of Soot Furnish Other Pertinent Topics

HALF a dozen papers on smoke abatement, a study of electric house heating, papers on stokers and water-wall construction, low-temperature carbonization, industrial heating, pulverized fuel and other matters of interest to central-station engineers filled the four-day meeting of the Fuels Division of the American Society of Mechanical Engineers at Philadelphia this week.

The paper of most novelty was perhaps one embodying a description of a photo-electric smoke recorder, written by V. P. Griffin and J. V. Breisky, connected respectively with the Duquesne Light Company of Pittsburgh and the Westinghouse Electric & Manufacturing Company. This scheme of operation involves projecting a beam of light through the stack or the breeching onto a photo-electric cell. In correspondence with the degree of density characterizing the smoke the cell receives more or less light, causing the flow of a smaller or greater amount of current. This current is then amplified to operate standard instruments, which are contained in weatherproof boxes. After proper calibration an accurate record of the amount of escaping smoke is indited in the boiler room.

At the power-plant session Ollison Craig, Riley Stoker Company, said that the decision in a particular case as to whether water tubes should be installed in the walls of a furnace, and the area of water-tube surface to be installed, depends on the load it is desired to develop, the economical limit of excess air and the fusion temperature of the ash in the coal. The increase in cost of such tube area must be set up against reduction in cost of boiler and furnace, reduction in cost of coal consumed and reduced cost of coal per ton.

J. S. Bennett and P. N. Oberholtzer, American Engineering Company, said that if only one wall of a furnace is to be cooled, it should be the rear one. Sometimes the sizes of stokers used in the older-type plants are limited by the ability of the furnace to withstand temperatures resulting from higher combustion rates. In many such cases a moderate investment in water cooling will give a substantial increase in steam output.

Alluding to the difficulty met in operating with low-grade coal, J. W. Pierson, Commonwealth Edison Company, said that at the Crawford Avenue generating station, where fouling has developed into a major problem, the soot blowers are operated every twelve hours and the boilers are lanced by air or water every fifth night. The alternative is to operate at high ratings with low over-all efficiency or at lower ratings with improved efficiency. Lower ratings reduce output.

Intersection Co-operation on the Pacific Coast

As the result of concurrent meetings of three different sections of the Pacific Coast Electrical Association held recently in San Francisco one particularly interesting trend was revealed—that of intersection co-operative effort. A full day was devoted to a joint meeting between the Engineering Section and the Purchasing and Stores Section for the discussion and consideration of ways and means of joint efforts between the two sections in studying questions of direct and vital interest to both. As a result a joint committee has been appointed which will attempt to work out details of effective co-operative effort with particular regard to a mutually satisfactory standardization of equipment and supplies.

The Transportation Section also has set as one of its aims for the current year full co-operation with the other sections of the association in any way affected by its own activities and responsibilities. Representatives of the other sections are to become active members of several of the committees of the Transportation Section, thus effecting a direct tie, it is hoped by section officials, particularly with the Engineering Section, the Accounting Section and the Public Relations Section.

Electragists Hear Experience of Executives

In addition to the papers at the convention of the Association of Electragists International, held at Swampscott, Mass., noted last week (page 702), John W. Hooley, president Electrical Contractors' Association of New York, recounted the results of six months' experience in that organization along co-operative lines and with recast personnel, dealing, as he put it, with minds open toward all branches of the industry. The speaker made a plea for the preservation of the differential between job cost and selling price and recommended the extension of the New York organization scheme to the national organization, favoring the establishment of key men in local contractor groups to make authoritative contacts in the field of employment, with members of other branches of the industry and in important outside affairs.

Allan Coggeshall, president Hatzell & Butcher, New York, in a paper on "Engineering Considerations in Electrical Contracting," pictured the opportunities before the electragist to obtain engineering information at present neglected. As a result of this paper it was voted to appoint a committee to consider technical opportunities.

W. C. Burton described the work of the Electrical Approval Bureau at St. Louis, and J. E. Vaughan, Jr., National Association of Credit Men, Chicago, outlined the successful operation of the Biddle credit control plan in more than 20 cities. Joseph Fowler, Memphis, Tenn., summarized a conference held at Niagara Falls, N. Y., September 28 between executives of the National Electrical Wholesalers' Association and of the electragists' organization. Plans were announced at this conference for the formation of credit interchange groups in various cities for the purpose of stabilizing credit information, terms and practices among jobbers, manufacturers, sales representatives and contractors.

A resolution of appreciation was passed commending the co-operation of the wholesalers' association in credit control activities. The program concluded on Thursday with sessions covering motor marketing licensing, arbitration, indirect lighting, industry relations, distribution costs, dealer merchandising, and the induction of the new officers, named in last week's report.

Three Small Hydro Projects Seek Federal License

A. E. Wilkinson of Cody, Wyo., has applied to the Federal Power Commission for a license covering a minor project on Middle Fork Creek, near Cody. The power is to be used for light and power at a mountain resort. This was the only application received by the commission in more than two weeks—the longest interval to elapse between applications since the passage of the act nine years ago.

The Atlas Packing Corporation of Seattle has applied for a license covering a small project on Baranof Island, Alaska. Approximately 100 hp. is to be developed to be used in operating a herring packing plant and a fish reduction works.

Roy F. Thornton of Mather, Calif., has applied for a license covering a constructed transmission line between Mather and Thornton Resort.

Hughes Hears Final Pleas on Chicago Diversion

Final arguments on the Chicago-Great Lakes water diversion case were heard before Special Master Charles E. Hughes last week in Washington, and it is expected that the decree will be recommended to the Supreme Court in the near future. The decision of the Supreme Court last January refrained from entering a decree stating just what the Sanitary District must do. In all probability the matter will not be ended when the special master submits his recommendations for an official court order, as either side will be permitted to file exceptions to Mr. Hughes' report.

Newton D. Baker, former Secretary of War, submitted a decree which the Lake States have drawn up and which they would like the Supreme Court to adopt. In this proposed decree it is required that all diversion from Lake Michigan by the Sanitary District be stopped by 1933 and that the withdrawal be decreased gradually up to that time. Those who presented the case for Chicago contended that it will require between fifteen and twenty years to complete the city's projects for sewage disposal. They contended that the present high level of water in the Great Lakes made the issuance of a decree unnecessary. Their opponents denied it.

Ford Boilers Will Generate 700,000 Lb. Steam Hourly

Two complete steam-generating units for the Fordson plant of the Ford Motor Company, Detroit, have been ordered from the Combustion Engineering Corporation, New York, for installation early in 1930. These units are designed for 1,350 lb. steam pressure, and the steam will be superheated to a total temperature of 750 deg. F. Each unit will have a maximum capacity of 700,000 lb. of steam per hour, which the manufacturers say is the highest steaming capacity ever attained in a boiler built for pressures as high as 1,350 lb.

The boilers will be fired by pulverized coal, the fuel entering the furnaces tangentially at the corners to give a turbulent mixing action of fuel and air for combustion. The furnaces will be of the all-metal, water-cooled type, and air preheaters will be installed to use the heat of the exit gases for preheating the air used for combustion.

Light and Power Men Address Safety Congress

Four papers making up a symposium on "Protection of the Public" were perhaps the high spot reached in the program of the Public Utilities Section of the National Safety Council's annual congress, held at Chicago last week. The viewpoints were respectively those of telephone and telegraph, transportation, gas and electric utilities. The light and power paper, by W. Briley Wright, of the Eastern Shore Public Service Company, Salisbury, Md., contained a thought that sometimes appears to be lost sight of by utility men working in the streets. This is that utilities use public property by sufferance only, whereas citizens use public property as a common-law right; therefore the burden of caution is definitely on the utilities.

An excellent paper, well illustrated with slides, on the safe handling of poles was presented by C. S. Holloway of the Illinois Bell Telephone Company. This paper was a virtual compendium of the subject, explaining methods and practices in minute detail.

Another outstanding contribution was from E. C. Stone, former chairman of the Engineering National Section, N.E.L.A. Mr. Stone contended that the safety standard set by industry is far higher than the safety standard which the people as a whole set for themselves and that industry has shown a consistent and marked improvement in its accident record over the period for which records are available.

Briefer News

No Vote on Sandusky Municipal Scheme This Year.—The Secretary of State of Ohio holds that the petition for a referendum on a municipal light plant at Sandusky does not meet legal requirements, and the city's board of elections accordingly cannot authorize submission to the voters on November 5. Backers of the movement say they will be "on the job" again next year.

Another Columbia River Project.—J. N. Hart of Portland, Ore., has filed an application with the state engineer for authority to approriate 60,000 sec.-ft. of water from the Columbia River for the purpose of developing electric power in Hood River County. The district covered by the application is now being served by the Pacific Power & Light Company.

First Section of Leeds (England) Power Station Nearly Ready.—The first section of the new electricity generating station at Red Cote, Kirkstall, for the corporation of Leeds, England, will be completed in a few months. The ultimate cost of the undertaking is estimated in the neighborhood of $10,000,000. The plant should be in operation early in 1930. The installation now being made is only one-third of the whole scheme, which will be completed in sections and brought into use as the demand for electrical power continues to increase.

Macon, Ga., to Have 110-Kv. Service.—Work is nearing completion on a 110-kv. transmission line connecting Macon, Ga., with Porterdale, 61 miles distant. The new line has H-type wooden poles, with 20 steel structures carrying the strain of long spans and angles. Connection will be made at Porterdale with the 110-kv. line from Tallulah Falls through Toccoa and Winder. Macon is now being served by a 66,000-volt line from the South Atlanta substation of the Georgia Power Company.

Senate to Investigate Lobbying.—Senator Norris, chairman of the Senate judiciary committee, has appointed a subcommittee to make a "wide-open" investigation of lobbying at the national capital. Its members are Senators Robinson of Indiana, Borah of Idaho, Blaine of Wisconsin, Caraway of Arkansas and Walsh of Montana, a majority of the subcommittee, including Mr. Norris himself, being radical in their attitude toward business and public utility companies.

Chicago Industrial Museum Appeals for Information and Suggestions.—The Museum of Science and Industry founded at Chicago by Julius Rosenwald is appealing for information concerning the location of machinery or apparatus of historical value which it might acquire by donation or otherwise, and also for suggestions from engineers concerning suitable exhibits. Electrical men especially are requested to help in giving America "the best technical museum in the world." Edward W. Kimbark, Rosenwald Industrial Museum, 300 West Adams Street, Chicago, can be communicated with.

Niagara Power Aids Aviation.—Niagara power is serving seven beacon lights for aviators in western New York. These are at East Pembroke, Newstead, Dunkirk, Angola, Brocton, Silver Creek and Batavia. Five are served directly, while two, one at Brocton and the other at Silver Creek, are served by Niagara electricity purchased by towns. The beacons at Batavia, East Pembroke and Newstead consume 1,150 kw.-hr. a month.

Illinois Public Utility Information Committee Issues Edison Booklet.—An unusually useful and appropriate item in the stream of literature now being produced in honor of Thomas A. Edison is a booklet of twelve pages put out by the Illinois Committee on Public Utility Information which contains a condensed illustrated biography of the inventor written in an interesting popular style and admirably adapted for general circulation as well as for reference.

Pearl Street Models Go to Henry Ford and Smithsonian Institution Museums.—One of the three operating models of the first electric central station—that on Pearl Street, New York—described in the Electrical World for March 2 (page 459) has been presented to Henry Ford for his Dearborn Museum and one to the National Museum of the Smithsonian Institution at Washington, the third being in the reception room of the president of the New York Edison Company. Metal models without the operating feature have also been made, and "Light's Golden Jubilee" has brought them into demand.

Increase in Utility Assessments in Nebraska.—The property of electric light, heat and power companies in Nebraska was assessed separately from other corporate property this year for the first time and, as given out by the state board of assessment, is valued for tax purposes at $7,264,000. The public service corporations, assessed on their franchises for the first time, will pay on a total of $4,500,000. A test case to determine whether the state board had authority to raise valuations without notice to the owners of the property affected is to be argued in the State Supreme Court.

Central Power & Light About to Start Construction of Third Hydro Plant on Devil's River.—The Texas board of water engineers has granted the application of the Central Power & Light Company of San Antonio for the diversion of 125 sec.-ft. of the flow of Devil's River in Val Verde County and for the erection and operation of a 60,000-hp. hydro-electric plant. The work of construction must start within 60 days and must be completed within two years, under the terms of the permit. The company will build transmis-

Japanese Utility Officials Visit Schenectady

THIS group of prominent officials from the Japanese electric lighting and power companies, representing public utility companies with an aggregate capitalization of approximately $500,000,000, are now, as before reported, on a tour of the United States, traveling under the auspices of the Tokyo Electric Company and the International General Electric Company, to study modern lighting installations and methods and the administrative and engineering problems of American electric central stations. The photograph was taken at the General Electric Company's Schenectady works.

sion lines from the plant to towns in the central Rio Grande border region of Texas. This will be the company's third hydro plant on the Devil's River. A steam plant is being built by it near Del Rio, on that stream.

YOUNGSTOWN AND SHARON JOINED BY NEW TRANSMISSION LINE.—Twelve miles of transmission line connecting two important points on the Pennsylvania-Ohio system has been placed in service between the Salt Springs substation, west of Youngstown, and the out-door substation at Masury, west of Sharon, Pa. Sixty-five steel towers were required for the line. The new Masury substation is of modern outdoor type. It is equipped with a bank of four 12,500-kva. transformers, with another one in reserve. Stevens & Wood are now rebuilding the line from Lowellville to Masury, and its capacity will be greatly increased.

MOHAWK-HUDSON CORPORATION'S FUTURE HYDRO PLANTS.—Further increases in power expansion on the Upper Hudson River district in New York State are forecast in recent reports that the Mohawk-Hudson Power Corporation is negotiating with the Union Bag & Paper Company for power rights at Hudson Falls which are said to involve construction of a 75,000-hp. plant. The first new plant for the Mohawk-Hudson system to be placed in operation, however, will be a 34,000-hp. development just below the Conklingville dam on the Sacandaga River. With the new Spier Falls unit already noted this will add 86,000 hp. to the Mohawk-Hudson's generating capacity.

ONTARIO ELECTIONS BRING PROMISE OF LOWER RURAL RATES.—The Ontario provincial elections will take place October 30, and Premier Ferguson promises a reduction of the charge for rural power service to a maximum of $2.50 a month, with legislation at the next session of the provincial Parliament to enable the rural customer to borrow upon reasonable terms the money with which to purchase all necessary electrical equipment. The Premier points out that in the present scale of rural rates the standard service charge for the average 100-acre farm is $4.55 per month. The government now proposes a general downward revision of rates.

MORE POWER NEEDED SOON FOR DES MOINES.—C. A. Leland, Jr., vice-president of the Des Moines (Iowa) Electric Light Company, addressing a public meeting in that city, recently announced that his company expects within two or three years to erect a large addition to the seven-million-dollar generating plant it completed only a few years ago. The old Des Moines River station on Center Street is now being operated in the early-morning peak period and may go on continuous schedule next winter, necessitating the speedy construction of a new unit, so as to retain an emergency plant.

IOWA COMPANIES REACH AGREEMENT OVER DISPUTED TERRITORY.—The Iowa Public Service Company and the Sac County Electric Company have arranged a truce in their controversy over disputed Sac County territory by entering into a power-purchase agreement and fixing respective fields in which each will operate, with a provision for the settlement of any dispute over invasion which may arise.

ALABAMA MAY TAX EXPORTED POWER.—The Alabama Public Service Commission has called on the Tennessee Electric Power Company to furnish more information on the company's plans to transmit power from Muscle Shoals into Tennessee. Counsel for the company advised the commission several days ago that the company planned to construct transmission lines from the government plant, saying that its business would be interstate and outside the jurisdiction of the Alabama utilities body. Certain interests in the state backed by newspapers are supporting a bill to be introduced in the next Legislature which would tax all energy exported out of the state.

NEW-KANAWHA POWER COMPANY'S CHANGE OF PLAN AUTHORIZED.—The New-Kanawha Power Company has received from the West Virginia Public Service Commission authority to build a dam at Hawk's Nest, a power plant near Gauley Junction station and a tunnel connecting the dam and power house, in accordance with the second revision of the original plans, on which a formal hearing was held before the commission on September 26, as noted last week (page 704). The connecting tunnel through which water will be diverted from the river at the dam to the power house will be from 28 ft. to 32 ft. in diameter and about 16,250 ft. long. The commission expressed the view that safety and security of the dam will not be adversely affected by the proposed changes.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue of July 6, page 46.]

International Association of Electrical Inspectors—Southern Section, Ansley Hotel, Atlanta, Oct. 15-17. R. L. Gatewood, P. O. Box 1743, Atlanta.

Kansas Section, N.E.L.A.—Hutchinson, Oct. 17-18. H. Lee Jones, Kansas Gas & Electric Co., Wichita, Kan.

Public Utilities Association of West Virginia—Charleston, W. Va., Oct. 23-24. A. Bliss McCrum, P. O. Box 1483, Charleston, W. Va.

Great Lakes Division, N.E.L.A.—Engineering Section, Lorain Hotel, Madison, Wis., Oct. 23-26. L. F. Hickernell, Stevens & Wood, Jackson, Mich.

American Engineering Council—Mayflower Hotel, Washington, Oct. 24-25. L. W. Wallace, 26 Jackson Place, Washington, D. C.

North Central Division, N.E.L.A.—Accounting Section, Nicollet Hotel, Minneapolis, Oct. 28 and 29. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

Public Utilities Association of Virginia—Chamberlin-Vanderbilt Hotel, Old Point, Va., Nov. 21 and 22. A. B. Tunis, 306 Grace Securities Bldg., Richmond, Va.

American Institute of Electrical Engineers—District meeting, Chicago, Dec. 2-4. F. L. Hutchinson, 33 West 39th St., New York.

INTERNATIONAL WATER COMMISSION WILL RECONVENE IN WASHINGTON ON OCTOBER 21.—The International Water Commission, which met in Mexico City in August to discuss the respective rights of the United States and Mexico in the Rio Grande and the Colorado and Tia Juana Rivers, will reconvene in Washington on October 21. In making this announcement the Department of the Interior dwells on the importance of the Boulder Dam to Mexico, in which country lies 100 miles of the Colorado River channel.

GEORGIA NOW HAS UTILITIES RATE ASSOCIATION.—Plans to raise a fund of $25,000 and employ one or more rate experts to compile data and represent Georgia communities before the Public Service Commission have been perfected at a meeting of the Municipal Utilities Rate Association of Georgia. Nine communities were represented—Albany, Americus, Atlanta, Augusta, Columbus, Macon, Newnan, Valdosta and Waycross—and Rome, Savannah and many other cities are expected to join. Under the constitution adopted individuals, firms and corporations may be admitted to membership along with the municipalities, and dues will be assessed against cities in proportion to their population.

PUGET SOUND POWER & LIGHT HAS SKYKOMISH RIVER PROJECT.—Application has been filed in Olympia, Wash., with the state hydraulics supervisor by the Puget Sound Power & Light Company, Seattle, for permission to appropriate 1,060 sec.-ft. of water from the South Fork of the Skykomish River in eastern Snohomish County, Wash., for power development. The plant, which would have an output of 20,500 hp. and would be built at an estimated cost of $1,825,500, would be about a mile east of the town of Index and near the confluence of the north and south forks of the river. A concrete diversion dam 15 ft. high and 300 ft. long would be built, and a fall of 170 ft. would be utilized in the project.

SECOND HEARING ON SANTIAM RIVER PROJECT IN OREGON BRINGS OUT PROTESTS.—If the Northwest Power Company, subsidiary of the Portland (Ore.) Electric Power Company, is permitted by the state to complete its proposed hydro-electric power project on the Santiam River and Marion Lake, power rates can, this utility declared at a second hearing recently, be materially reduced in territory served by it. In reply to a demand from the city of Salem that at least 40 sec.-ft. of the water of the North Santiam be reserved

for the future domestic use of the municipality, the applicant produced figures which showed that in the portion of the stream from which water would be diverted for the power project there would remain at low-water period 39 sec.-ft. of flow. Protests from the State Fish Commission and the city of Albany were based on possible damage to the fish life in the river and the lake and to recreational features.

WHOLESALE METER TESTS IN MINNESOTA.—Pursuant to a law passed in 1927 and in furtherance of which an appropriation was made by this year's Legislature, state-wide tests of electric and gas meters by the Minnesota Railroad and Warehouse Commission have begun. The law provides for a test of meters in all districts, cities and villages not in the first class upon petition and payment of a 25-cent fee by at least 25 subscribers. At Savage, where the tests began, 27 owners of meters asserted that the voltage was low and that meters were not recording correctly. Chief Engineer Jargensen found that thirteen of these meters were correct, seven fast and seven slow. The fees collected will be turned over to the weights and measures department of the commission.

ELKINS, W. VA., TO VOTE AGAIN ON ESTABLISHING MUNICIPAL PLANT.—Citizens of Elkins, W. Va., are scheduled to vote on November 26 for the second time upon the question of constructing a municipal electric plant, as the result of action taken by the Elkins City Council upon an ordinance which had been pending since the West Virginia Supreme Court sustained the decision of the Attorney-General in holding the first bond issue invalid on technicalities. Rates for lighting and industrial power were reduced in the spring by the Monongahela-West Penn Public Service Company, and it was hoped the election would be dropped.

ALBANY, N. Y., IS SAFEGUARDED AGAINST INTERRUPTION OF ITS POWER SUPPLY.—At Bethlehem Center, a few miles south of Albany, N. Y., a substation with an initial capacity of 12,000 kw. is being constructed by the New York Power & Light Corporation which will give the city and the surrounding territory a greatly enlarged power supply and will almost eliminate the possibility of interruption to service. At present Albany is served from two main transmission substations, one to the north in Menands, with a capacity of 30,000 kw., and the other to the east at East Greenbush, with a capacity of 12,000 kw. When the Bethlehem substation is finished the city will thus have three outside sources of supply. Energy will be received at the new substation at 66,000 volts over a new tower line from Unionville, connecting with the company's main transmission lines. This power will be stepped down to 13,200 volts. The substation is designed to provide for ultimate 110,000-volt operation.

Commission Rulings

UNIFORM MANAGEMENT OF SCATTERED PROPERTIES HELD UNLIKELY TO INCREASE OPERATING COSTS.—In granting approval of the merger of the Western New York Gas & Electric Corporation with the New York State Electric Corporation, the New York Public Service Commission disagreed with the contention of an opponent of the merger who maintained that an examination of the state-wide affairs of a large operating company would make the investigation of rates by a small community practically impossible. "The fixation of rates," the commission said, "involves an examination of operating costs and the valuation of property devoted to the particular service. Obviously, where the operating utility serves widely separated communities with scattered or disconnected systems an examination and allocation of proper management costs is involved when rates are questioned. That, however, should not be a difficult task. Uniform management should not effect an increase of operating expenses. It should, and usually does, result in lower costs. Any change that tends to a reduction of operating costs can operate only in the interest of the public."

CONSOLIDATION HELD TO BE IN INTEREST OF SMALL CONSUMERS.—In authorizing the Central Vermont Public Service Corporation to do business within the state the Vermont Public Service Commission expressed the view that the economic benefits that spring from consolidation are in the interest of the small consumer, as well as scientific and promotional rate making. The commission said: "We believe that the domestic consumer of electricity has been neglected in the past by the utilities. He uses energy after the factory and store have closed for the day, thus contributing materially and beneficially to the well-balanced load for the 24-hour period. He pays more than 64 per cent of the total revenue derived from electric service rendered. Power customers of electricity consume it in such quantities that they may protect themselves against excessive rates by installing their own facilities for generation. This fact creates a competitive situation which tends to induce the utility to keep its rate as low as or lower than the power can be produced by the manufacturer, but the domestic consumer has no recourse save to the oil lamp, Delco system, or some similar device for the production of light."

COMPANY ALLOWED TO CORRECT REDUCED RATES ESTABLISHED BY MISTAKE AND AGAINST COMMISSION'S ORDER.—The California Railroad Commission has refused to entertain a plea by a milk company against the Southern Sierras Power Company, which sought a refund of charges for electricity made by the company in excess of a published schedule. It appeared that in December, 1923, the commission permitted the Southern company to purchase the properties of the Holton Power Company on the condition that the "consolidation will not result in any change of management or rates." Thinking that its own schedule was identical with the Holton company's schedule, the Southern company filed and published the same as applicable over the entire Imperial Valley, which included the territory formerly served by the Holton company. This was Schedule P-22, effective January 1, 1924, and it would have resulted in a material reduction in charges to several consumers in the territory formerly served by the Holton company. The Southern company, however, because of its misapprehension, made no changes in billing consumers taken over from the latter company. The error did not come to the attention of the Southern company until August, 1924, when the commission permitted it to file a new schedule, P-31, effective by special permission retroactively as of January 1, 1924. The former schedule of the Holton company and Schedule P-31 were identical. The complainant contended that Schedule P-22 was the lawful published rate and demanded a repayment of all excess charges made since that time.

Recent Court Decisions

JURISDICTION OVER SUBMETERING REFUSED TO DISTRICT OF COLUMBIA COMMISSION.—The Supreme Court of the District of Columbia has dismissed four suits brought by owners of office buildings and apartments in Washington to enjoin the Potomac Electric Power Company from refusing to serve the complainants at wholesale rates in order that they might supply their tenants through submeters at increased price, this action by the company following a decision by the Public Utilities Commission of the District. The court refused because it found that the commission's order did not forbid submetering but merely approved a form of contract offered by the power company containing provisions against submetering. On the question of jurisdiction over submetering the justice said: "As I construe the statute, the Public Utilities Commission has no jurisdiction over the particular kinds of submetering involved in these cases."

AUTHORITIES CANNOT ARBITRARILY DENY POWER COMPANY A PERMIT TO APPROPRIATE WATER.—The Yuba River Power Company appealed to the California Supreme Court against a decision of the state authorities made at the instance of the Nevada Irrigation District and denying to the power company the right to appropriate water from the Yuba River, where the irrigation district was a claimant further upstream. The reviewing court held that since the power company had fully complied with every provision of the water commission act, entitling it to receive preferential right to appropriate water from the river for beneficial use, and since there was unappropriated water sufficient to comply with its applications, the power company prior to issuance of a permit acquired a valuable property right and was authorized to bring an action in equity in the nature of suit to quiet title to determine adverse claims to use of water so sought as between itself and upper claimant threatening to invade right of priority claimed. The granting of a permit to appropriate water for power and irrigation purposes, the court said, is not the right itself, but merely confirming evidence of the right theretofore existing, and an application for a permit cannot be arbitrarily rejected, since to do so would deprive the applicant of a valuable property right without due process of law.

News About Men of the Industry

T. W. Martin Elected to Board of Affiliated Companies

Thomas W. Martin has been elected a member of the board of directors of the Commonwealth Power Corporation and of its subsidiary companies, the Tennessee Electric Power Company and the Consumers Power Company, all of which are affiliated with the Commonwealth & Southern Corporation. The new positions to which Mr. Martin has been named are in addition to those which he holds in a number of other constitutent companies of the Commonwealth & Southern group.

EDWARD J. KRAMER has joined the staff of the Electrical League of Rochester as secretary-manager.

HERBERT SOUTHWORTH, formerly sales manager for the Quincy Electric Light & Power Company, Quincy, Mass., has been named merchandise manager of the Fall River Electric Light Company.

ERNEST V. PANNELL, technical adviser to the British Aluminium Company, Ltd., in New York for the past ten years, will in the near future take over the management of the London Aluminium Company, Ltd., Birmingham, England, a manufacturing organization, specializing in stampings and other fabricated forms of aluminum and light alloys.

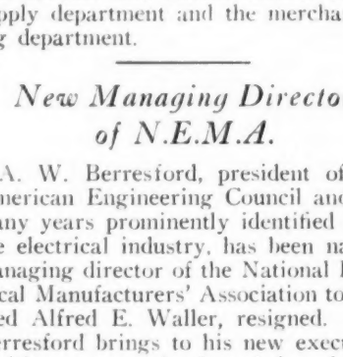
ERIC M. BEACH, advertising manager of the Westinghouse Lamp Company, has resigned to establish his own business in providing a specialized advertising service to manufacturers whose volume of business does not warrant the employment of a man on full time for creative and executive work. Mr. Beach will maintain offices in New York.

JOSEPH F. O'BRIEN has been appointed advertising manager of the Westinghouse Lamp Company, effective October 1. Mr. O'Brien advances to this position from that of assistant to the vice-president, where he gained a wide acquaintance with jobbers and agents and an intimate knowledge of the problems of retail dealers. Mr. O'Brien's most recent work of note was in the supervision during the period of development and construction of the Westinghouse Lighting Institute, a job that was accomplished in the record time of seven weeks.

H. C. THOMAS has been appointed director of manufacturing stocks of the Westinghouse Electric & Manufacturing Company with offices in East Pittsburgh. In his new work he will be responsible for the methods used in the control of all raw materials, work in progress and finished part stocks. Mr. Thomas is being advanced from the position of assistant general manager of the merchandising department with offices in Mansfield, Ohio. Since his graduation from Purdue University in 1910 Mr. Thomas has held various positions with the Westinghouse company in the repair department, the circuit breaker and switch section of the supply department and the merchandising department.

New Managing Director of N.E.M.A.

A. W. Berresford, president of the American Engineering Council and for many years prominently identified with the electrical industry, has been named managing director of the National Electrical Manufacturers' Association to succeed Alfred E. Waller, resigned. Mr. Berresford brings to his new executive position an extensive knowledge of electrical and general engineering and a broad background of experience in industrial enterprises. For some two years following the completion of his technical education, obtained at the Brooklyn Polytechnic Institute and Cornell University, he undertook some general engineering work similar to that in which the average graduate engineer engages. His first significant connection was as designer with the Riker Electric Company, which was followed by a connection with the Ward Leonard Electric Company, where he had charge of testing and designing. Two years later, in 1898, he, with two others, purchased the assets of the Iron Clad Rheostat Company from the receiver and formed the Iron Clad Resistance Company, of which he became vice-president and manager. When this organization was purchased by the Cutler-Hammer Manufacturing Company in 1900 Mr. Berresford entered the engineering department of the latter company. In 1901 he was made superintendent, one year later secretary, and in 1905 general manager. It was in 1907 that he was named vice-president and general manager, a position he occupied until 1923, when he resigned, feeling a need for rest from business pursuits.



Mr. Berresford again became actively identified with the electrical industry in 1926, when he became executive vice-president of the Nizer Corporation, following the consolidation of that organization with the Kelvinator Corporation and the Grand Rapids Refrigerator Corporation, operating as divisions of the Electric Refrigeration Corporation. In the summer of 1927 he severed his connection with the refrigeration branch of the industry, when he resigned as vice-president of the Electric Refrigeration Corporation in charge of engineering and development.

The electrical industry has always been prompt in recognizing the eminent services of Mr. Berresford. During the war he was chairman of the General War Service Committee of the Electrical Manufacturing Industry and was in addition chairman of the General War Service Committee of the Electrical Manufacturers of Electrical Supplies. He is a past-president of the American Institute of Electrical Engineers, the Electrical Manufacturers' Club, the Associated Manufacturers of Electrical Supplies and a member of the American Society of Mechanical Engineers, the Society for the Promotion of Engineering Education and of other technical associations.

RALPH PALMER, chief engineer at the Alexandria plant of the Virginia Public Service Company for the past seven years, has resigned on account of poor health.

WILLIAM WOOD has been appointed chief engineer at the Alexandria plant of the Virginia Public Service Company to succeed Ralph Palmer, resigned. Mr. Wood was formerly Mr. Palmer's assistant.

A. L. O'BANION, for the past five years instructor in electrical engineering at Cornell University, has been appointed professor of electrical engineering at Clemson College, South Carolina, to succeed Prof. S. R. Rhodes, who has been made head of the division of electrical engineering.

LELAND B. SNODDY, Lexington, Ky., has been granted an Edison Fellowship for research in the research laboratory of the General Electric Company at Schenectady, N. Y., for the year 1929-1930. This fellowship was established by the General Electric Company this year in honor of Thomas A. Edison and in commemoration of the fiftieth anniversary of his incandescent lamp. Mr. Snoddy is the first recipient of the fellowship and was chosen from a number of candidates. He begins work this month. The fellowship carries a grant of $3,000 and its purpose is to give the fellow an opportunity to carry on research work of his own choice, provided

suitable laboratory facilities are available. Mr. Snoddy received his technical education at the University of Kentucky and University of California and then joined the teaching staff of Lynchburg College, Lynchburg, Va., as head of the physics and chemistry departments. As a teacher and administrator there he was instrumental in greatly improving the standards of the chemical and physical laboratories, and as an able research man he has already won recognition from his colleagues.

CHARLES FABRI, director of the Société Générale de Belgique, has been elected to the board of directors of the United States Electric Power Corporation, the holding company recently organized by United Founders Corporation, Harris Forbes Corporation, Hydro-Electric Securities Corporation, Albert Emanuel & Company and other interests.

EDMOND S. MCCONNELL, formerly assistant electrical engineer with the American Brass Company, Waterbury, Conn., has been transferred to Chicago, where he has assumed the duties of sales engineer with the Anaconda Wire & Cable Company, an affiliated company, with Western offices in Chicago.

F. R. BUSSLER, for the past seven years general superintendent for the Wooster (Ohio) Electric Company, has been named superintendent of construction of the Eastern New Jersey Power & Light Company, Asbury Park, N. J., for the Management & Engineering Corporation of Chicago. Mr. Bussler is succeeding GORDON MILLER, who is assuming new duties in Indianapolis.

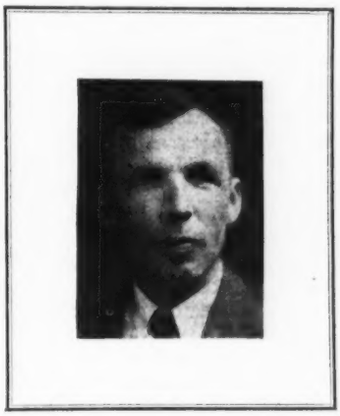
COLONEL R. E. B. CROMPTON, British electrical pioneer, in spite of his 84 years, is seeking fresh fields to conquer, having just entered into partnership with Dr. Alfred Ekstrom, M.I.E.E., who has specialized in the problems of applying electrical energy to agriculture in Sweden. The partners will act as consultants on similar matters in the United Kingdom and the British colonies.

ERNEST ZSCHAU, distribution engineer of the Nebraska Power Company, Omaha, has been named industrial engineer of the local Chamber of Commerce. Mr. Zschau entered the employ of the company in 1924 and was assigned to the power station as a switchboard operator. He remained for approximately a year, and during this period he also engaged in some electrical work for the Phoenix Utility Company. Subsequently he was transferred to the engineering department.

H. O. HILL, who has been in charge of transmission work for the Riter Conley Company, Pittsburgh, manufacturer of steel transmission towers and substation steel, has been made chief engineer of the company. Mr. Hill will, however, still retain an active interest in transmission work. J. T. DONALDSON, formerly chief engineer, has been made consulting engineer and ALEX HARDIE has been made transmission engineer.

P. L. Alger Heads Electrical Machinery Committee

Philip L. Alger, whose appointment as chairman of the electrical machinery committee of the American Institute of Electrical Engineers was recently announced, graduated from St. John's College, Maryland, in 1912, and subsequently took the electrical engineering course at Massachusetts Institute of Technology. Following graduation he spent two years as instructor and research assistant at Massachusetts Institute of Technology, where he worked principally on core losses under the direction of Prof. C. A. Adams. He also took the General Electric test course in 1916. After being discharged from military service, he entered the induction motor engineering department of the General Electric Company at Schenectady, where he spent five years. Then he was transferred to the alternating-current engineering department of the same company, serving at the present time as assistant engineer. Mr.



Alger has presented a number of papers before the Institute on machinery design and has been a member of the electrical machinery committee for the past three years. He is a member of the American Mathematical Society, the Society for the Promotion of Engineering Education and the American Association for the Advancement of Science.

IRVING LANGMUIR, associate director of the research laboratory of the General Electric Company and president of the American Chemical Society, has been made the recipient of the honorary degree of doctor of science by Princeton University. Dr. Langmuir was one of a group of American and foreign scientists who were thus honored on the occasion of the formal opening of the university's new chemical laboratory. The citation reads as follows: " . . . recipient of prizes and honors from national and foreign societies in both physics and chemistry. In 1909 he was called to take a leading part in carrying out a far-sighted policy of fostering research in pure science, adopted by the General Electric Company. In the laboratory of this great industrial corporation Langmuir has for twenty years attacked fundamental problems with the freedom of an academician, yet with all the powerful resources of the industrial engineer. Langmuir's is the accepted concept of adsorption and orientation of molecules at surfaces; his studies have furnished us a mechanism of gas reactions at the surface of the metal tungsten, universally used in electric illumination, long-distance telephony and radio."

A. A. H. UHALT has been appointed campaign specialist to head the new campaign section which has developed in the electric refrigeration department of the General Electric Company with headquarters in Cleveland, Ohio. This section is a branch of the merchandising service department and will assist utilities in planning and conducting their campaigns on General Electric refrigerators.

RAGNER A. O. SIGNEUL, electrical designer of Stockholm, Sweden, is now connected with the Boston office of the New England Power Association. Mr. Signeul is a graduate of the Royal Technical University of Stockholm, where he studied electrical engineering. He was identified with Stone & Webster before entering the employ of the New England Association.

Obituary

A. H. BERGENDAHL, New York district manager of the Trumbull Electric Manufacturing Company, died as the result of an operation for appendicitis at the Stuart Circle Hospital in Richmond, Va., October 3. Mr. Bergendahl had been associated with the Trumbull company for eighteen years, having represented it in the Cleveland-Pittsburgh district for many years. He was transferred to New York as manager of the New York territory in the early spring. He was 36 years of age.

PAUL BURT MUNSON, for four years manager of the Tacoma (Wash.) branch of the Westinghouse Electric & Manufacturing Company, died in that city September 27. Mr. Munson was for eleven years connected with the Seattle office of the Westinghouse company.

EDWARD WARREN ROLLINS, a member of E. H. Rollins & Sons, investment bankers of Boston, died October 6 at Dover, N. H. Mr. Rollins was born in Concord, N. H., in 1850 and was graduated from the Massachusetts Institute of Technology in 1871. Five years later he became president of the banking house. For the past few years he had been honorary chairman of the board. Early in his career Mr. Rollins spent some time in the West, and while in Denver he became interested in the public utility industry in that city. He was a director of the Cities Service Company and of the Southern California Edison Company.

Financial and Statistical News

RUMORS that the Federal Trade Commission is about to issue a rather critical progress report on its findings in connection with the finances of utility holding companies are not substantiated. ELECTRICAL WORLD'S Washington correspondent is advised by officials of the Federal Trade Commission that there is nothing to support the rumor that the commission will comment critically on the financial side of its investigation. No testimony has been taken as yet on that phase of the probe. The next progress report will be issued October 15 and, as far as is known, there will be little to report except the reopening of hearings.

——LOW MONEY RATES HAVE HAD THE EFFECT of stimulating both speculative and investment buying of bonds. The bond market, including utility issues, has enjoyed substantial recovery, especially in the convertible issues.

——UTILITY STOCKS HAVE GIVEN A GOOD ACCOUNT of themselves in the general recovery from last week's liquidation. Losses have been approximately half recouped, on the average, in the active utility issues (October 9).

General Gas & Electric to Exchange Stock

The General Gas & Electric Corporation has announced an offer to holders of its $7 and $8 cumulative preferred stocks for the exchange of these securities for $6 cumulative convertible stock of the company, which carries the privilege of conversion at the holder's option at any time between May 1, 1930, and May 1, 1935, into class A common stock at the rate of one and one-tenth class A shares for each $6 preferred share.

The exchange offer announced to holders of the $7 cumulative preferred stock is at the rate of one and one-tenth shares of $6 cumulative preferred stock series B for each share of $7 stock, while to holders of the $8 cumulative preferred stock are offered one and one-quarter shares of $6 preferred stock series B for each $8 share held. The $6 stock is of equal rank with both the $7 and $8 issues.

The new $6 convertible preferred stock series B will carry dividends from September 15, 1929, and stockholders will not be required to make any payment for the additional half-month's dividends prior to October 1, the dividend date of the $7 and $8 issues.

Detroit Edison Offers Additional Stock

Stockholders of the Detroit Edison Company will be offered the right to subscribe on December 23, 1929, for additional stock at par ($100 per share) in the ratio of one share for each five shares held of record on October 28, 1929. Subscriptions will be accepted for full shares only. Payment of subscriptions may be made in full on December 23, 1929, or in four installments on December 23, 1929; March 21, 1930; June 21, 1930, and September 22, 1930. Holders of the company's 6 per cent convertible debenture bonds, series of 1932, may participate in the stock offering by converting their bonds on or before October 28, 1929.

President Alex Dow said in his letter to stockholders: "Since early in 1929 we have resorted to current borrowings to provide part of the large amount of funds which has gone into construction. In view of existing bond market conditions, it is the opinion of the board of directors that no substantial senior financing should be undertaken at this time and that funds presently required should be provided by the sale of stock. Stockholders were offered rights to subscribe for stock in December of last year and an additional offering will be made for subscription in December of this year to enable the company to retire its floating debt."

Customer-Ownership Sales Increase in July

Rise in customer-ownership stock sales during July is indicated in the returns received by the ELECTRICAL WORLD from central-station companies selling stock directly to customers, employees and local parties. On the basis of those returns the value of securities thus marketed is estimated at $21,200,000, the number of shares at 332,100 and the number of transactions at 36,800. These figures are greatly influenced by the operations of one system that reported sales of more than $10,000,000 during the month.

The July sales far exceed in money value those of any month since May, 1928, when sales for the month reached the unusual value of $48,506,000; of that amount over $36,000,000 represented chiefly exchanges for a 7 per cent issue of an earlier date.

Stock sold in customer-ownership campaigns is usually divided into two groups, one of stock selling at or close to $100 per share and the other of low-priced stock averaging around $25 per share. This month we find a wider variation in the selling price of stock; in addition to the two classes mentioned reports show stock being sold at $75, around $50 and some as low as $18 per share.

Another unusual feature of the July sales was the sale of more than one and three quarter millions of stock in 893 transactions, which means the average value per transaction was $1,965. On the total sales for the month the average value was $576 per transaction and the average price per share $64.

Revised figures for June show sales valued at $13,400,000; although the number of shares and transactions in some cases were not given, the totals for the month are estimated at 166,600 of the former, in 23,500 transactions.

New Bedford Merger Terms Announced

New England Gas & Electric Association, a part of the Associated Gas & Electric System, has offered stockholders and holders of stock trust certificates of the New Bedford Gas & Edison Light Company the privilege of exchanging for each share of their holdings paying dividends of $4 per annum one $5.50 dividend preferred share, exchangeable, series B, of New England Gas & Electric Association, exchangeable at the holder's option after December 31, 1929, into six and one-quarter new shares of General Gas & Electric Corporation common stock, class A. Stockholders making the exchange will receive on January 1, 1930, full quarterly dividend from October 1, 1929, on New England Gas & Electric Association preferred stock at the rate of $5.50 per annum, as well as a quarterly dividend on shares of the New Bedford Gas & Edison Light Company payable October 15, 1929.

Holland Uses 145-Kw.-Hr. per Capita

Twenty-two central stations, serving 919 of the 1070 Dutch communities and having a total generating capacity of 614,000 kw., generated nearly 1,105,000,000 kw.-hr. in 1927, as against 449,000,000 kw.-hr. in 1920.

Out of a present population of 7,626,000, 96.5 per cent are within reach of the central station lines, which comprise 5,690 miles at 10 kv. and 380 miles at 25 and 50 kv. In one part the voltage is now being raised to 120 kv.

Much of the energy is consumed in residential service. Of 195,300,000 kw.-hr. sold in 1928 by the Amsterdam central station, 34.5 per cent was used for

industrial purposes, 9.6 per cent for public lighting and 51.5 per cent for domestic and lighting purposes, the latter percentage including 9,800,000 kw.-hr. for heating water, 54 per cent of ti for night storage tanks.

In 1928 the electric railway between Amsterdam and Rotterdam consumed 45,000,000 kw.-hr., the energy being supplied through automatic substations in which the alternating current from various central stations is converted to continuous current at 1,500 volts by means of Brown-Boveri rectifiers.

Market Recovery Corrects Level of Values

ONE outstanding feature of last week's drastic market liquidation and the rebound which followed was the establishment of an entirely new alignment of stocks apparently at levels nearer actual values. The movement involved a sifting out process which seemed to bring the good stocks back and leave the weaker issues at lower levels, whence they had been buoyed up merely by general market strength.

The sharp rebound after the selling seemed like new evidence to support the old adage "the rich get richer, etc." The well-established, proved stocks, generally the high-priced stocks, quickly regained a large part of their loss, while the doubtful list, usually lower-priced stocks, found greater difficulty in securing public support. It was these latter stocks, generally, which had been held by the mass of smaller traders, many of whom were squeezed out of the market in the liquidation process.

On the other hand, stocks like General Electric and Westinghouse Electric each recovered about one-third of their loss in less than one full trading session. Many of the higher-priced utility stocks did almost equally well and the sound low-priced utilities followed suit. The utility market in general showed remarkable recovery, with a few exceptional gains, in the first two or three sessions.

Market authorities seem fairly unanimous that the credit situation has not improved measurably. The past fortnight added $235,000,000 to brokers' loans after a net increase for September of probably $800,000,000. New stock issues during September were exceedingly heavy, which caused a further drain upon bank credit. According to the president of the American Bankers' Association, the present condition of brokers' loans is "unsound and detrimental to the public good."

Canada's Power Increase Parallels Ours

Canadian central stations generated 1,444,314,000 kw.-hr. in August, according to the Monthly Review of Business Statistics published by the Dominion Bureau of Statistics. Only 1.3 per cent came from fuel, water-power producing 1,424,951,000 kw.-hr.; 131,070,000 kw.-hr., or 9 per cent of the total, was exported. The output was nearly 10 per cent greater than in the corresponding month last year, compared with a 13 per cent increase in July and 10 per cent in June. In Quebec the August increase, compared with 1928, exceeded 12 per cent. In Ontario it was about 7.5 per cent.

New Capital Issues

Puget Sound Power & Light Company
First and refunding mortgage gold bonds, series A.
Amount, $8,000,000.
Price, $97¾ and interest, to yield over 5.65 per cent.
Period, twenty years.

Puget Sound Power & Light Company is a subsidiary of the Engineers Public Service Company and operates in the western part of the State of Washington, serving a population estimated at more than 1,000,000. The series A and B bonds are a direct obligation of the company and are secured under the first and refunding mortgage by a direct lien on substantially all electric light and power and other properties owned directly by the company subject only to certain divisional underlying bonds on parts of the properties. Proceeds from the sale of the bonds will be applied toward additions to plant and the discharge of obligations incurred in connection therewith or in connection with the payment of underlying bonds recently retired and to other corporate purposes.

United States Electric Light & Power Shares
Trust certificates.
Amount, $1,000,000.
Price, $58 per share.

United States Electric Light & Power Shares, Inc., was organized in 1927 to invest in securities of companies doing essentially an electric light and power business. The company's holdings include stocks of electric light and power companies which serve directly or through subsidiaries over one hundred of the largest cities in the United States. The holdings vary from 1,000 shares of United Illuminating Company (New Haven) stock to 20,000 shares of Southern California Edison Company common, to the largest holding of 90,000 shares of the North American Company common. Trust certificates, series A,

Current Earnings Reports of Electric Light and Power Companies

	1929	1928	Per Cent Increase	Operating Ratio 1929	Operating Ratio 1928
Associated Gas & Electric System (Year ended July 31)					
Gross earnings	$65,784,842	$41,511,826	58.0	54	55
Net earnings	30,324,546	18,539,417	64.0	..	..
Central Illinois Light (Year ended August 31)					
Gross earnings	4,982,385	4,639,938	7.4	58	60
Net earnings	2,071,481	1,861,160	11.3	..	..
Cities Service (Year ended August 31)					
Gross earnings	39,885,689	33,450,189	10.6	..	..
Net earnings	38,657,916	32,315,254	10.6	..	..
Commonwealth & Southern & subs. (Year ended August 31)					
Gross earnings	145,464,771	132,891,824	9.4	49	51
Net earnings	74,416,922	65,834,967	13.0	..	..
Consumers Power (Year ended August 31)					
Gross earnings	32,964,592	28,999,378	13.7	50	50
Net earnings	16,742,047	14,387,325	16.4	..	..
Electric Power & Light & subs. (Year ended June 30)					
Gross earnings	57,385,076	53,550,186	7.2	52	54
Net earnings	27,569,880	24,275,510	13.6	..	..
Kansas City Power & Light (Year ended August 31)					
Gross earnings	14,358,660	13,485,688	6.5	51	51
Net earnings	7,029,585	6,594,531	6.6	..	..
Nevada-California Electric & subs. (Year ended August 31)					
Gross earnings	5,595,388	5,345,136	4.7	47	43
Net earnings	2,956,665	3,064,642	—3.5	..	..
New York Power & Light (Year ended August 31)					
Gross earnings	21,595,279	19,910,628	8.4	58	57
Net earnings	9,240,350	8,474,555	9.0	..	..
Public Service Corporation of New Jersey & subs. (Year ended August 31)					
Gross earnings	133,068,725	122,230,408	8.8	..	..
Net earnings*	40,447,712	34,880,548	16.0	..	..
Southern California Edison (Year ended August 31)					
Gross earnings	38,386,490	33,392,928	15.0	34	33
Net earnings	25,399,677	22,479,268	13.0	..	..
Tennessee Electric Power & subs. (Year ended August 31)					
Gross earnings	14,158,108	13,076,963	8.3	51	54
Net earnings	6,930,551	6,104,781	13.5	..	..
Texas Power & Light (Year ended July 31)					
Gross earnings	9,687,238	9,508,805	2.0	51	54
Net earnings	4,781,918	4,319,652	11.0	..	..
Utah Power & Light (Year ended July 31)					
Gross earnings	11,472,392	10,816,490	6.0	49	49
Net earnings	5,847,285	5,501,042	6.0	..	..

*After depreciation.

represent shares of beneficial interest in the income accruing from such securities.

Central Vermont Public Service Corporation
Preferred stock.
Amount, 32,000 shares.
Price, $96.50 per share and accrued dividend to yield over 6.21 per cent.

Central Vermont Public Service Corporation serves with electric light, power and gas a large number of communities in the central and southern parts of Vermont and the western part of New Hampshire. The corporation is a part of the Middle West Utilities System. The electric system includes hydro-electric generating stations owned and operated having a total installed capacity of approximately 17,778 kw.

Southern Ohio Electric Company
First mortgage gold bonds.
Amount, $2,487,000.
Price, $95 and accrued interest, to yield about 5.85 per cent.

Southern Ohio Electric Company is acquiring all of the assets (except certain cash and accounts receivable) of the Chillicothe Electric Railroad, Light & Power Company and of the Ohio Utilities Company. Upon completion of this acquisition the company will do all of the electric light and power business in 70 communities in the prosperous agricultural and industrial territory south of Columbus, Ohio.

General Water Works & Electric Corporation
Gold debentures, series B.
Amount, $7,250,000.
Price, $95 ½ and accrued interest, to yield 6.50 per cent.
Feature, convertible at principal amount into class A common stock, after October 1, 1930, and before October 1, 1940.

General Water Works & Electric Corporation subsidiaries render electric light and power, gas, water and other services in 216 communities in Texas, Kentucky, New Mexico, California, New York, Missouri, Alabama, Pennsylvania, Idaho, Indiana and other states. These debenture are dated October 1, 1929, and mature October 1, 1944.

Canada's Growing Electrical Industry

Production from the electrical apparatus and supplies industry in Canada was valued at $93,672,452 in 1928, according to a statement published by the Dominion Bureau of Statistics. This figure was the highest total ever reported for the industry, and was 19 per cent over the value of $78,558,730 for the previous year. Substantial increases in the output of electrical supplies have been made during recent years. In 1924 reports showed an increase of $5,000,000 over the preceding year; successive annual gains were, respectively, $4,000,000, $9,000,000, nearly $9,000,000, and finally more than $15,000,000, in 1928.

The 137 firms in this industry reported fixed and working capital at $87,952,674 and afforded employment to a monthly average of 18,193 people. Salaries and wages amounted to $22,756,209. Purchased materials cost $38,784,421 at the works, and the value added by manufacturing processes was $54,888,031.

Only 34 per Cent of August Energy from Water

August energy production in public utility plants (including railway and other plants as well as central stations) was 8,259,425,000 kw.-hr., of which 2,840,237,000 kw.-hr. came from water power and 5,419,189,000 kw.-hr. from fuels, according to the U. S. Geological Survey's report. The total exceeds that of July by 3 per cent and that of June by 6 per cent, the figures for those months being 8,014,113,000 kw.-hr. and 7,768,435,000 kw.-hr. respectively. It is 10 per cent greater than in August, 1928. The output from water power fell below that of 1928 in June and July, and in August was decidedly less than last year; that from fuel, correspondingly, was 20 per cent greater. Because of the continued low precipitation the output from water power in September will probably be found to have fallen under that of September, 1928.

French Utility Shares Advance

Market valuations of leading electrical shares in France have advanced rapidly of late. Comparison of prices over the past two years shows steady appreciation. Progress of the electrical construction companies apart from the generating and distributing concerns has been rapid.

The latest available estimate of the amount of capital invested in producing and distributing companies is 8,500,000,000 francs, of which 5,000,000,000 is in stock and 3,500,000,000 in bonds.

News Briefs

American Commonwealths Power Corporation has granted class A stockholders new option warrants permitting them to purchase at $24 a share one additional share of A stock for each share now held.

Public Service Company of New Hampshire has inaugurated the sale of stock to customers with a local offering of preferred stock, at the special price of $98 to yield 6.12 per cent. Offer will expire October 15.

Hamburg Electric Company (Hamburgische Electricitäts-Werke) will retire on November 1 its outstanding ten-year sinking fund 7 per cent external gold debentures, due November 1, 1935, amounting to $70,000. Bonds will be redeemed at par and accrued interest.

Niagara Hudson Power Corporation production for August was 585,472,000 kw.-hr., against 523,267,000 kw.-hr. for the corresponding month of 1928, an increase of more than 11 per cent.

Central States Electric Corporation has been granted a charter amendment to increase its maximum authorized common stock from 10,000,000 shares to 20,000,000 shares.

Quebec Power Company, through the sale of some 50,000 additional shares of stock, will realize $2,500,000, which will be used to pay for necessary improvements to plant and for new equipment. The stock will be issued to stockholders on a one-for-ten basis.

ADDITIONS MADE TO UNITED STATES ELECTRIC POWDER BOARD. — Baron Schroeder of J. Henry Schroeder & Company, London, and John L. Simpson, vice-president J. Henry Schroeder Banking Corporation, New York, have just been added to the board of the United States Electric Power Corporation, recently formed by Harris Forbes, American Founders, Hydro-Electric Securities and others. The other directors are Harry M. Addinsell, Arthur C. Allyn, Chellis A. Austin, Chester Dales, George E. Davendorf, Victor Emanuel, C. L. Fisher, E. Carleton Granbery, William C. Langley, John R. Macomber, Charles D. Makepeace, Thomas A. O'Hara, Erwin Rankin, Royal E. T. Riggs, Louis H. Seagrave and William H. Seibert.

NORTHERN OHIO POWER ELECTS NEW DIRECTORS—Allan F. Ayers, president of the Ohio State Bank & Trust Company, Akron, Ohio; James G. Robertson, investment broker and formerly treasurer of the Firestone Tire & Rubber Company, and L. G. Tighe, assistant general manager of the Northern Ohio Power & Light Company, were elected directors of the Northern Ohio Power organization, at a meeting of the board held in Cleveland. Mr. Ayers will succeed to the place made vacant by the resignation of R. P. Stevens of New York. Mr. Robertson will take the place of Edward Clark of Philadelphia, a director for many years, and Mr. Tighe succeeds the late Charles Curry.

NORTH AMERICAN GAS & ELECTRIC OFFERS RIGHT TO CONVERT DIVIDEND—Stockholders of the North American Gas & Electric Company are being offered the privilege of converting their dividends on the company's class A stock, $1.60 dividend series, into additional shares of stock on the exchange basis of one full share for each 50 shares held, according to announcement made by Leo Loeb, vice-president of the company. The third quarterly dividend of 40 cents per share on th s stock has been declared payable November 1, 1929, to stockholders of record on October 5, 1929.

SEATTLE SYSTEM REPORTS RECORD OUTPUT.—During the month of August the Seattle municipal light and power system produced 29,356,800 kw.-hr., breaking all previous records and exceeding that of August, 1928, by about 22 per cent, according to the report of J. D. Ross, superintendent. Of the output stated, the Skagit hydro-electric plant produced 25,890,000 kw.-hr., or 88.2 per cent, of the total production. The Lake Union steam plant generated 1,700,000 kw.-hr. and the Cedar Falls hydro-electric plant 1,286,000 kw.-hr. From the Tacoma municipal plant the Seattle system bought 480,000 kw.-hr.

Business News and Market Conditions

National Electrical Exposition Marks Amazing Advances

PROBABLY few who attended the National Electrical Exposition held at Grand Central Palace, New York, this week under the auspices of the Electrical Association of New York paused to contemplate the full significance of the display in relation to the anniversary with whose commemoration the exposition was combined. The 50-year span since Mr. Edison invented the incandescent lamp marks an era of marvels due to electrical development which have become so commonplace as to be taken entirely for granted.

But to the appreciative visitor the exhibits represented a truly amazing advance. They included the regular variety of electrical appliances designed to eliminate domestic drudgery and thus to raise the standard of living. These included many improvements on previous design in automatic cleaners, washers, sewing machines, health equipment and the rest. Then there were such devices as one to determine the acoustic properties of a building before it has been erected, the electric traffic cop, the automobile radio set, a variety of electric clocks and many types of apparatus for the advancement of medical science. A feature of this year's exposition was the educational aspect, which was especially stressed throughout.

Daily addresses by outstanding speakers were another feature which added greatly to the interest. Among these speakers were: Matthew S. Sloan, president New York Edison Company; S. E. Kimball, Kimball Electric Company; W. S. McClure, New York Edison Company, and Earl Whitehorne, president of the Electrical Board of Trade. From Mr. Sloan's address appears the following:

"With these tools has been introduced a new element that makes this age distinct—the principle of the transmission of power from a distant source, the principle inherent in Edison's conception of the incandescent lamp, and the application of this power through these tools to the performance of a task. This principle underlies the thousands of electrical appliances on exhibit here. They are useless without electric current. The current is of no avail without them. On this mutual dependence a great system is built up to supply a public with the most specialized, flexible service that has ever been known. This ability of the electrical industry to serve is in a large measure determined by the extent to which that public makes use of such tools as those we see here. The Electrical Exposition thus plays its part in the scheme of advancing human betterment by stimulating the public to a wider and more diversified use of electrical appliances."

The exposition this year was under the management of professional show managers, a decidedly successful experiment, in the opinion of a number of exhibitors whose opinion on the matter was solicited.

India Uses Larger Volume of Electrical Goods

India's electrical requirements are growing by leaps and bounds. Requirements both for domestic and for industrial uses are imported in larger quantities each year. The increase in these imports since 1925 has amounted to nearly 40 per cent, or more than 9 per cent per year.

While the United Kingdom supplies most of these goods, Germany and the United States are capturing an increasing share of the trade. There are other competitors for the trade, such as the Netherlands, Italy and Japan.

Electrical imports are divided into two classes—electrical machinery and electrical instruments and apparatus. A large increase is seen in each of these groups and new electrical developments are under way all over India, so that the requirements will grow steadily year by year.

Electrical Industry Holds Trade Practice Conference

Eight branches of the electrical industry of the United States are holding a trade practice conference with the Federal Trade Commission beginning Thursday, October 10, in Washington at the Wardman Park Hotel. Chairman McCulloch of the commission will preside.

Eight separate consecutive conferences are being held for the manufacturers of carbon brushes, representing more than 75 per cent of the total production of these products in the United States; manufacturers of molded products, representing 70 per cent of the industry based on volume; flexible cords and heater cords, 75 per cent of the

American Industry and Branch Plants

NATIONALITY of industry is no longer coincident with geographic location in view of the present-day economic interdependence of the nations.

* * *

The problem of whether or not to establish branch plants involves intricate problems. There are numerous other factors as well as wages to be considered. Some of the earliest motives were:

To effect possible savings in freight.

To forestall competitive effort.

To satisfy foreign patent laws, and new tariff legislation.

Nationalization arising out of war conditions.

There are, however, numerous other factors on which the success or failure of the branch plant depends. There may be radical labor laws.

Among the advantages of branch plants are:

1. Stimulation of exports of American machinery.
2. Favorable reaction on local standard of living and general buying power.
3. Means of securing business from behind high-tariff walls.
4. Saving in freight rates.
5. Necessity of capitalizing lower wage rates.
6. Nationalistic propaganda.

There may be the following disadvantages.

1. Foreign development will curtail our commerce.
2. Diplomatic or political complications may arise.
3. Foreign tariffs are liable to sudden changes.
4. Labor laws may be altered suddenly.
5. Contiguous market may suddenly disappear.
6. War and armament debts may have to be shared.
7. Mass production may be impossible.

Thus each case must be examined on its merits. It is essential that those charged with final decision shall penetrate far into the background of every aspect of the situation.

Excerpts from an address by Dr. Julius Klein, Assistant Secretary of Commerce, before McGraw-Hill staff.

Delinquent Electrical Accounts

NUMBER OF ACCOUNTS REPORTED

Division	August 1928	August 1929	Per Cent Increase or Decrease	Eight Months 1928	Eight Months 1929	Per Cent Increase or Decrease
New York	288	314	+ 8.6	2,424	2,032	—16.1
Middle and Southern Atlantic	246	178	—27.6	1,529	1,305	—14.6
New England	183	106	—48.0	1,035	1,133	+ 9.4
Central	648	578	—10.9	6,278	5,036	—19.7
Total	1,367	1,176	—13.8	11,286	9,506	—15.6

TOTAL AMOUNTS REPORTED

	August 1928	August 1929	Per Cent Increase or Decrease	Eight Months 1928	Eight Months 1929	Per Cent Increase or Decrease
New York	$42,222	$62,309	+47.5	$350,038	$458,293	+31.0
Middle and Southern Atlantic	27,742	22,888	—17.5	196,445	187,792	— 4.4
New England	19,442	19,484	— .26	128,605	160,120	+24.5
Central	75,732	69,747	— 7.8	748,310	614,634	—17.8
Total	$165,138	$174,438	+ 5.8	$1,423,398	$1,420,839	— 0.18

production; vulcanized fiber, almost the entire production in the United States; panelboards and distribution boards, 75 per cent of the business based on production; electrical mica, 75 to 80 per cent, and manufacturers of outlet boxes and switch boxes, 80 per cent of the industry, and manufacturers of carbon arc lamps, 60 per cent of the production.

Among practices proposed for discussion are: Including breach of contract; secret rebates; arbitration; contracts ambiguous and incomplete in form and wording; misbranding; piracy of styles; fraud; misrepresentation; unbranded products; price discrimination; price schedules; commissions and bonuses; selling below cost; standardization of sizes; terms of credit; options; guaranteeing against advance or decline in price; post-dated contracts, and defamation of competitors.

Kuhlemeyer Wins McGraw Award

Did Much to Awaken Interest in Better Methods of Cost-Keeping, Estimating and Selling Among Contractors and Dealers

THE contractor-dealers' medal and purse for 1929 given under the James H. McGraw Award was presented to John Kuhlemeyer at the meeting of the Association of Electragists at Swampscott, Mass., last week. The award was given in recognition of Mr. Kuhlemeyer's outstanding services to the contractor-dealer branch of the electrical industry through his practical leadership in promoting sales economies and his personal guidance to the contractors in many cities in establishing better methods of estimating and cost-keeping and generally healthier competition. The citation follows:

John Kuhlemeyer, while an electrical contractor in Chicago, impressed with the inefficiencies of the average contractor in the conduct of his business affairs, became active in local association work, in the hope that he could awaken interest in better methods of cost-keeping, estimating and selling among Chicago contractors and dealers. Out of this experience he developed a definite formula to aid the contractor to know his costs and to protect his profits and with it a fine zeal to preach the gospel of sound economics to the men engaged in small wiring business. He voluntarily enlisted himself in the work of the local electrical leagues and at the invitation of these organizations began to work with the contracting groups of different communities, teaching the simple, common sense of cost analysis and competition. By practical schooling in meetings and through personal counsel to individuals to help them straighten out their own policies and methods, in the last several years he has brought about a most gratifying improvement in the economic health of the electrical trade of many cities, notably Youngstown, Chattanooga, Knoxville, Binghamton, Akron and Cincinnati.

The committee of judges which awarded the medal to Mr. Kuhlemeyer consisted of Charles M. Beltzhoover, A. Lincoln Bush, Hugo Tollner and James M. Burn. The committee of awards consisted of W. W. Freeman, H. B. Crouse, W. E. Robertson, L. K. Comstock, F. M. Feiker and Earl Whitehorne.

In 1926 the medal and purse were awarded to Louis K. Comstock, in 1927 to Joseph A. Fowler and in 1928 to N. Jay Biddle.

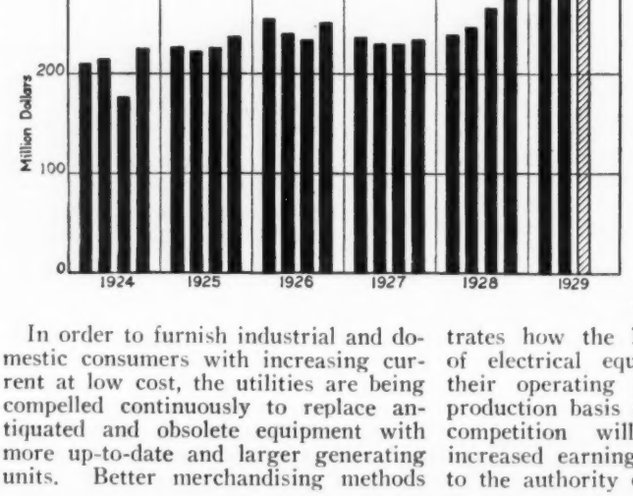
Copper Market Firm

Though business in copper again was below the average in volume, prices ruled firm in all directions. The market held at 18 cents for Connecticut deliveries and 18⅛ cents in the Middle West. Most of the business placed during the week was for November delivery and inquiry in the market points to some substantial buying for this position. October wants of consumers appear to be well taken care of, although some business did go through in prompt shipment metal. A little copper sold for January-February delivery. The trade is awaiting publication of the September statistics and most operators look for a reduction in stocks of refined metal of more than 10,000 tons. Against this drop in refined copper an increase in holdings of blister is expected. The movement of copper into consuming channels is progressing at a steady rate, owing largely to the sustained activity in wire, cable, and brass industries.

New York Metal Market Prices

	Oct. 2, 1929 Cents per Pound	Oct. 9, 1929 Cents per Pound
Copper, electrolytic	18	18
Lead, Am. S. & R. price	6.90	6.90
Antimony	8.50	8.40
Nickel, ingot	35	35
Zinc, spot	7.15	7.15
Tin, Straits	43.65	43.40
Aluminum, 99 per cent.	24.30	24.30

Electrical Equipment Sales Reach New High Level



In order to furnish industrial and domestic consumers with increasing current at low cost, the utilities are being compelled continuously to replace antiquated and obsolete equipment with more up-to-date and larger generating units. Better merchandising methods of household appliances are stimulating the sale of labor-saving devices. Furthermore, railroad electrification processes are giving rise to large orders for materials and equipment.

The accompanying chart, representing total orders for electrical goods as computed by the Standard Statistics Company, illustrates how the leading manufacturers of electrical equipment have attuned their operating processes to a mass production basis and in spite of severe competition will show substantially increased earnings for 1929, according to the authority quoted.

Market Conditions

ELECTRIC RAILWAY EQUIPMENT buying continues heavy in the East. Central stations are buying heavily both in the Eastern and Southeast districts. Motor sales are a specialty in New England.

——SWITCHGEAR AND SWITCHING EQUIPMENT are prominent in Middle West business.

——CENTRAL-STATION BUYING has eased off somewhat on the Pacific, especially in the Puget Sound area.

SOUTHEAST

SATISFACTORY business continues the rule in the Southeast in electrical lines. The largest orders last week were for the waterwheels and generators for the Oconee development of the Georgia Power Company and these orders aggregated $530,000. The next largest central station orders were for power transformers, amounting to $50,000, and switchboard costing $27,000.

Some other central station orders were for capacitator equipment amounting to $6,500; conduit, totaling $6,500; distribution and small power transformers, costing $6,300; $5,500 in insulator equipment, and house type meters amounting to $4,550. A steel mill in the Birmingham district ordered mill equipment totaling $80,000, while a Georgia textile mill ordered $6,000 worth of small motors. Electrical contracts will be let on the first within 60 to 90 days, while the contracts on the second project will be let within 45 to 60 days. A Georgia power company has closed a 29-selling-day campaign in which refrigerator equipment amounting to $400,000 was sold. Contracts will be let within ten days on a 31-standard white way for Madison, Ga., and the city of Atlanta will let a contract for an addition to its white way system, which addition will call for $1,500 in electrical materials. Construction projects follow:

Virginia Public Service Company, Charlottesville, Va., plans transmission line between Alberta and Lawrenceville. Appalachian Electric Power Company, Bluefield, W. Va., plans extensions and improvements in steam-operated electric power plant at Logan, W. Va., to cost $400,000. Tennessee Electric Power Company, Chattanooga, Tenn., plans extension in transmission lines at Nashville, Tenn., and vicinity. Buckeye Cotton Oil Company, Cincinnati, Ohio, has filed plans for a pulp mill at Memphis, Tenn., to cost $250,000. Allen Manufacturing Company, Nashville, Tenn., plans plant at Franklin, Tenn., to cost $200,000. Southern Public Utilities Company, Charlotte, N. C., plans transmission line in Lake County. Carolina Power & Light Company, Raleigh, N. C., plans construction of transmission line from Castalia to Spring Hope, N. C., and vicinity, reported to cost $40,000. Mississippi Central Power Company, Jackson, Miss., will make extensions and improvements in transmission and distributing lines at McComb, Miss., to cost $50,000. State Teachers College, Hattiesburg, Miss., has plans for power plant reported to cost more than $80,000. West Point, Miss., is considering extensions and improvements in municipal power plant to cost more than $75,000, with equipment. Cordele, Ga., plans electric light and power distributing system to cost $50,000.

EASTERN

HEAVY buying continues for equipment for electric railway service in the Eastern district and each week is adding a quota of commitments that is bringing record sales in this line; the outlook for continuance is excellent. Industrial demand is gaining momentum and sizable orders are in prospect during the next 30 to 60 days.

The Great Northern Railway Company has contracted with the General Electric Company for four 3,000-hp. electric locomotives for its electrified division through the Cascade Mountains, to cost approximately $1,000,000. The Chicago, Burlington & Quincy Railroad has placed an order for ten gasoline-electric cars for early delivery. The electrification programs of steam railroads continue to expand; the Pennsylvania Railroad Company is having plans completed for such work on its line from Manhattan Transfer, near Newark, N. J., to New Brunswick, about 20 miles, using overhead system, estimated to cost $6,000,000. In the near future the project will be continued from the last noted point to Trenton; work is now in progress on the electrification of the road from Trenton to Philadelphia. The Reading Company has announced intentions of electrifying its line from Philadelphia to New York, about 92 miles; an expenditure of $20,000,000 is now being made by that system in the Philadelphia territory.

Industrial account shows marked revival in the Eastern district, with a heavier group of basic industries in the market. A cement mill in northern New York has placed an order with a state manufacturer for a turbo-generator unit, motors, controls and auxiliary equipment to cost $130,000. A prominent manufacturer of stokers in the Middle West is securing a heavy advance in orders from electric power utilities. Construction projects follow:

Robert Gair Company, New York, will build an addition to its corrugated box-manufacturing plant at Piermont, N. Y., to cost about $500,000. American Tobacco Company, New York, will build a multi-story factory addition at Reidsville, N. C., to cost about $300,000. Knickerbocker Ice Company, New York, has filed plans for a four-story manufacturing plant to cost $200,000. New York Trap Rock Corporation, Newburgh, N. Y., will build a stone-crushing plant at Clifton Point, N. Y., to cost close to $1,000,000. International Nickel Company, New York, has plans for two additions to its mill at Huntington, W. Va., reported to cost more than $300,000. Borden's Farm Products Co., Inc., New York, will build a distributing plant at Rockville Center, N. Y., to cost $200,000. Wright Aeronautical Corporation, Paterson, N. J., has approved plans for new unit at aircraft engine plant to cost in excess of $500,000. Department of Property and Supplies, Harrisburg, Pa., will receive bids until October 18 for a power plant at the State Teachers' College, East Stroudsburg. Women's Medical College and Hospital, Philadelphia, Pa., has approved plans for institutional buildings to cost $1,000,000. Tarentum Steel Corporation, Tarentum, Pa., has approved plans for local plant to cost about $1,500,000. Mutual Telephone Company, Erie, Pa., will build an equipment storage and distributing plant to cost $150,000. American Sheet & Tin Plate Company, Pittsburgh, Pa., will carry out an expansion and betterment program at its works at Farrell, Pa., to cost more than $3,000,000, requiring a year for completion. Hercules Powder Company, Wilmington, Del., has approved plans for a laboratory and experimental plant to cost more than $250,000. General Purchasing Officer, Panama Canal, Washington, D. C., will receive bids until October 25 for sockets, fuses, light fixtures and other electrical supplies (Panama Schedule 1998). Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until October 22 for insulated wire and cable for Eastern and Western yards (Schedule 1959), and until October 29, for air compressors for different yards (Schedule 1932). Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids until October 30 for a 6-ton ammonia compressor with auxiliaries for Mare Island, Calif., naval hospital (Specification 5997), and bids (no closing date stated) for a superheater (Specification 6033) and for an underfeed mechanical stoker (Specification 6017) for the Boston navy yard.

NEW ENGLAND

CONTINUED buying in small lots is reported by manufacturers in this district. Small motor sales are ahead of the total reported last year. The demand for motors, together with inquiries regarding deliveries, is an encouraging sign of industrial activity at present and for the coming months. Small switches and control are selling well; scheduled equipment orders are reported in good volume; one manufacturer notes an improvement in buying heavy equipment.

Recently an order for a 1,500-kw. turbo-generator for an eastern Massachusetts plant was received. Negotiations are increasing; electrical equipment to be purchased soon includes several large motors and accessories.

Central-station equipment orders are spotty; transformers are more active

than a short time ago; considerable stocking up of scheduled equipment is noted. Watt-hour meter sales are gaining and regulator orders are steady. Outside material orders have fallen off; new line material orders were less during the past week. Electric heating furnaces are active in interest. Street traffic signal units increased about 50 per cent in sales for this year to date, according to one manufacturer; refrigerator and domestic electric appliance sales are at a high level. Construction contracts follow:

Pratt & Whitney Aircraft Corporation, East Hartford, Conn., has filed plans for a power plant to cost $85,000. Milford, Conn., plans installation of floodlighting system and beacon lamps at municipal airport. Norma-Hoffman Bearing Corporation, Stamford, Conn., will build an addition to precision bearing plant to cost $100,000. Meriden, Conn., plans trade school to cost about $100,000.

Pacific Coast

SEPTEMBER business did not uphold the promise of August and the year's total for the jobbers averages about 5 per cent poorer than last year. Dealers and contractors report business only fair. Railroad buying is good and is featured by heavy conduit and wiring supply purchases for the El Paso shops. Power company buying is limited to maintenance material, except a few outstanding apparatus orders.

The industrial machinery orders recorded a General Electric elevator equipment for a San Francisco insurance building and a $60,000 elevator and automatic landing control equipment for the Seattle city and county building. Oil company prospective business includes material for wiring and floodlighting 500 junior service stations in northern California and 40 in southern California, and a $2,000,000 cracking plant in Bakersfield. One carload of ranges each for Seattle and San Francisco jobbers is reported by Westinghouse. Large prospective building covers a $1,250,000 hospital for Los Angeles, a $600,000 paint plant for the same city and federal buildings costing $4,000,000 and $11,000,000 for San Francisco and Los Angeles, respectively. A southern California power company estimates its fall purchases will be $1,000,000 for substation transformers, $900,000 for copper wire and $150,000 for regulators.

With the exception of sales of single-phase condenser motors to eastern Washington orchard districts, where demand is good, movement in the Puget Sound area last week was very light. Prospects, however, are reported good. Central-station buying is very light in the Puget Sound district, but there are good prospects for immediate business in British Columbia from hydro-electric projects. Central station buying aside from usual small orders included $4,000 worth of switchgear and one 73-kv. oil circuit breaker, costing about $5,500, to a Seattle station. Specifications for approximately $250,000 worth of electrical apparatus and motors for a pulp and sawmill of the Olympic Forest Products Company, a Zellerbach subsidiary, in Port Angeles, is expected within a month. A lighting system on Fox Island, costing $10,000, ornamental street-lighting systems in Tacoma and Chehalis, costing about $22,000 and $10,000, respectively, are planned. An addition is planned for Olympia, Wash., knitting mills and the Vancouver (Wash.) Crossarm Company is contemplating a factory with a daily capacity of 20,000 ft. Construction projects follow:

Imperial Valley Irrigation District, El Centro, Calif., contemplates installation of steam-operated electric power plant of 6,000 kw. capacity, using Diesel engine units, reported to cost $100,000. Oakex Company, Eureka, Calif., has plans under way for rebuilding of tanning extract plant to cost $100,000. National Ice & Cold Storage Company, San Francisco, Calif., has filed plans for plant at Hollister to cost $200,000. Shell Development Company, St. Louis, Mo., is reported planning nitrogen plant at Long Beach, Calif., to cost $300,000. Berkerley, Los Angeles, and Ventura, Calif., plan ornamental lighting systems. Puget Sound Light & Power Company, Seattle, Wash., has applied for permission to build hydro-electric power plant on Skyhomish River, near Everett, Wash., to cost $2,000,000. Electro-Kold Corporation, Spokane, Wash., plans refrigerating plant to cost about $100,000. Colorado Power Company, Pueblo, Colo., plans transmission line in vicinity of Canon City, about 10 miles. Fleetcraft Airplane Corporation, Lincoln, Neb., plans aircraft plant at Denver, Colo., to cost $200,000.

Southwest

CONDITIONS remain the same in this district as in late reports. The present season has been specially marked in the steady demand for all kinds of stock apparatus. Up to the present time there has been no reduction in the volume of this business, which has come mainly from industrial plants. The only line which has not been up to normal is building construction materials.

A contract has been closed for six vertical-type water turbines, 35,000 hp. each, and two auxiliary wheels, 1,600 hp. each, all to cost about $1,000,000. These machines are for the Ozark project and designed for 90 ft. average head. Another contract was for two water turbine units, 22,500 kva. each, for an Arkansas power company, cost not given; a 12,500-kw. steam turbo unit for a Texas company, costing about $200,000, and a seven-panel switchboard with connection equipment costing $10,000. Jobbers are fairly active in all lines. Construction projects follow:

Empire District Electric Company, Joplin, Mo., has completed surveys for hydro-electric power plant at Bronson, Mo., to cost $15,000,000. Perry-Hannibal Coal Company, Perry, Mo., plans installation of mining plant for output of 500 tons per day, reported to cost more than $200,000. Inland Waterways Corporation, Helena, Ark., will build a grain elevator to cost $130,000. Indiana Limestone Company, Bedford, Ind., plans plant near Austin, Tex., to cost $200,000. Baton Rouge, La., plans floodlighting system and beacon lamps at municipal airport, entire project to cost $160,000.

Middle West

GENERAL business in the Middle West section continues to show improvement. The volume of business is gradually increasing and a feeling of optimism is quite prevalent. The major activities, steel, railroad, automotive and agricultural industries, are in good shape, with every prospect for a continuance of present prosperity during the last quarter of the year. There has been a good demand for larger apparatus.

Some of the interesting orders placed this week include one for switchgear and switching equipment valued at $1,150,000, three 20,000-kva. oil-insulated, self-water-cooled and forced-oil-cooled, single-phase, 60-cycle, series-parallel power transformers, three 2,222-kva. regulating transformers, condensing equipment valued at $350,000, one 13,000-amp., 225-275-volt totally inclosed synchronous booster lighting converter complete with accessories and several construction orders aggregating $150,000. Construction projects follow:

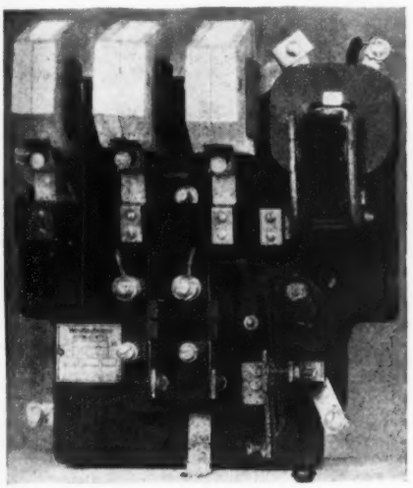
Oshkosh Corrugated Box Company, Oshkosh, Wis., plans addition to cost $175,000. Hayes Body Corporation, Grand Rapids, Mich., plans plant unit at South Bend, Ind., to cost $200,000. Motor Wheel Corporation, Lansing, Mich., plans addition to cost $200,000. The Wayne County Board of Commissioners, Detroit, Mich., will soon take bids for power plant to cost close to $80,000. MacDonald Brothers Engineering Laboratory, Inc., Boston, Mass., plans plant at Detroit, Mich., to cost more than $300,000. Chicago, Burlington & Quincy Railroad Company, Chicago, Ill., plans freight terminal at Galesburg, Ill., to cost $5,000,000. Commonwealth Edison Company, Chicago, Ill., plans two power substations to cost $100,000. Northwestern Terminals, Inc., Evansville, Ind., plans coal-handling and distributing plant to cost about $100,000. Central Alloy Steel Company, Massillon, Ohio, plans extension and improvements in local mill and branch plant at Canton, Ohio, to cost $500,000. Sandusky, Ohio, contemplates municipal electric light and power plant. Electric Auto-Lite Company, Toledo, Ohio, plans plant at Sarnia, Ont., to cost more than $2,000,000. Allegheny Oil Company, Canton, Ohio, plans oil refinery to cost $500,000. J. L. Shiely Company, St. Paul, Minn., will build a sand and gravel plant at Verendrye, N. D., to cost $100,000. Beatrice Power Company, Beatrice, Neb., plans transmission line from Barneston to Odell, Neb. Central West Public Service Company, Omaha, Neb., plans street lighting system at Kimball, S. D. Greenlease-Lied Motor Company, Omaha, Neb., plans service, repair and garage building to cost $200,000. Nebraska Power Company, Omaha, Neb., plans transmission line extensions in vicinity of Colon, Neb. Des Moines Electric Light Company, Des Moines, Iowa, plans steam-operated electric power plant to cost $1,000,000.

New Equipment Available

Line Starter Without a Cabinet

A line starter without a cabinet for such applications as those in which it is desirable to mount the starter within the machine is announced by the Westinghouse Electric & Manufacturing Company.

Like the other line starters, this starter is also equipped with a "Deion" arc quencher and the thermal overload relay. According to the manufacturer, the "Deion" arc quencher is the most



effective arc-rupturing device yet incorporated in starters. It provides the highest degree of protection from flashovers under severe operating conditions and also increases the life of the contacts, it is claimed. Because the arc is completely restricted within the arc quencher, the over-all size of the starter has been decreased without any decrease in safety.

Another added feature is the combined hand and automatic reset thermal overload relay. The automatic reset of this relay relieves the necessity of the operator going to the starter to put the motor back on the line after an overload. This also permits remote mounting with minimum loss of time and greater machine output.

Hydraulic Operator—Control Device

A new industrial control device, called the "Hydraulic Operator," is announced by the General Electric Company to take the place of large alternating- or direct-current magnets and solenoids. It may also be used to replace air cylinders where quiet and smooth upward thrust is desired through a given distance.

The new device consists of a motor-driven centrifugal oil pump, the impeller of which is mounted in a piston and driven by means of a spline shaft. This permits the stationary mounting of the motor. The normal position is with the piston at the bottom of the cylinder, which is approximately two-thirds full of oil. When energized, the motor drives the impeller, creating a pressure between the bottom of the piston and the bottom of the cylinder.

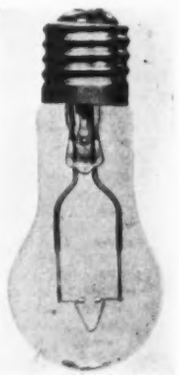
The piston is cast so that the oil is fed to the center of the impeller from both the top and bottom. The oil is forced from the end of the impeller blades through ports to the space below the piston. The pressure tends to move the piston upward and it will travel the full length of the cylinder, providing the load on the ends of the push rod is not too great.

The operators are rated on the stalled thrust basis; that is, the number of pounds they will balance when the motor is running at full speed. The three standard sizes give 200, 300 and 600 lb. push. The speed of operating is slower than that of a solenoid, but is relatively fast. The motors used are small, $\frac{1}{4}$ to $\frac{1}{2}$ hp., and therefore come up to speed very rapidly (in approximately 0.1 second).

Sun Lamp Eliminates Ultra-Violet Rays

A new home type sun lamp, developed as an efficient substitute for natural sunlight in aiding the maintenance of health, has been introduced by the merchandise department of the General Electric Company, Bridgeport, Conn.

The bulb of the lamp is of special glass that eliminates the shorter ultra-violet rays, which, it is said, should be used only under the supervision of a physician. The special glass of the bulb is so designed as to permit only the passage of beneficial rays corresponding to direct sunlight through clear atmosphere in midsummer.



The base of the lamp standard is an ornamental housing inclosing a transformer for reducing the voltage of the ordinary house circuit from 110 volts to the operating potential of the lamp. The unit can be plugged into any convenience outlet.

The bulb is a special development of the General Electric Company and is distinctly new in design. A tungsten filament and a pair of tungsten electrodes are contained as a unit in the bulb. When the switch is turned on the filament is lighted to bright incandescence. The heat thus liberated quickly vaporizes a small quantity of mercury within the bulb, so that within a second or so a mercury arc is set up between the two tungsten terminals that are attached to the same supports as is the filament. When the arc is established the filament is bypassed and the transformer automatically adjusts the voltage for the new current conditions.

It is reported that the lamp built as a household unit will be marketed by both the General Electric Company and the Westinghouse Lamp Company through their respective outlets.

Clamp Insulator Support

A new line of clamp insulator cable supports for either flat or pipe mounting, by means of U-bolts, is announced

by the Champion Switch Company, Kenova, W. Va.

The white glaze porcelains are interchangeable, the supporting bases are malleable iron, and the top clamps are of alloy metal. The mechanical strength is high and the porcelain is designed for installations of wide temperature variations, such as exist in coke plants, foundries, etc.

A New Type of General Utility Outlet, for which certain outstanding advantages are claimed, is announced by the Rattan Manufacturing Company, New Haven, Conn. The outlet is furnished in two ratings, 10 amp., 250 volts, and 15 amp., 125 volts. It is a complete unit, consisting of box body, cable connectors, convenient outlet and flush plates. The connector snaps in and out of the spring yoke. There is a large head screw for ground wire, when required.

Illuminated Dial Clock.—The Warren Telechron Company, Ashland, Mass., has devised a tiny lighting arrangement that directly illuminates the face of a clock, making it plainly seen in an otherwise darkened room. This lighting device consists of a small winding, around the same core as the motor winding, so that the voltage for the lamp is cut down by a transformer. It uses a 2.5-volt lamp, but only applies about 50 per cent of the normal voltage.

Electrical Patents

Announced by U. S. Patent Office

(Issued September 17, 1929)

1,728,579. ELECTRIC SWITCH; V. A. Trier, London, England. App. filed Sept. 7, 1927.

1,728,592. AUTOMATIC IGNITION SWITCH; W. A. Clarke, Jr., New Lexington, O. App. filed Oct. 18, 1927.

1,728,596. MULTIPLE CONTROL; H. D. Currier, Chicago, Ill. App. filed April 2, 1925.

1,728,602. AUTOMATIC STREET SIGNALING SYSTEM; H. Garrett, Dallas, Tex. App. filed Feb. 16, 1925.

1,728,616. ELECTRIC SPOT-WELDING MACHINE; D. Kondakjian, Newark, N. J. App. filed Dec. 12, 1925.

1,728,623. ELECTRIC PLUG RECEPTACLE; W. S. Mayer, Philadelphia, Pa. App. filed Feb. 1, 1922.

1,728,627. FLASHING RECEPTACLE; J. W. Phelps, Chicago, Ill. App. filed Feb. 21, 1927.

1,728,633. SPEED REGULATOR; K. Schmidt, Berlin-Lichtenrade, Germany. App. filed Sept. 23, 1926.

1,728,666. SOCKET CASING; E. J. Curren, West Haven, Conn. App. filed Oct. 22, 1928.

1,728,691. ELECTROLYTIC RECTIFIER; R. D. Mershon, New York, N. Y. App. filed Oct. 21, 1919.

1,728,692. ELECTRIC CLOCK DRIVE; E. Michl, Kosice, Czechoslovakia. App. filed March 17, 1922.

1,728,717. SUSPENSION INSULATOR; O. Becker, Berlin-Henningsdorf, Germany. App. filed June 9, 1924.

1,728,735. WINNING OF METALS FROM METAL-BEARING MATERIALS; R. Rodrian, New York, N. Y. App. filed June 22, 1927.

1,728,745. ELECTRIC RELAY APPARATUS EMPLOYING THERMIONIC VALVES; W. J. Brown, Stockport, E. J. E. Hubbard, Horsham, E. Y. Robinson, Manchester, and C. R. Burch, Stratford, England. App. filed Nov. 8, 1924.

1,728,746. DISPLAY APPARATUS; J. Cannella, New York, N. Y. App. filed May 12, 1928.

1,728,752. ELECTRIC HEATING UNIT; H. A. Frietchen, Mansfield, O. App. filed Nov. 6, 1928.

1,728,755. SPEAKER UNIT; C. F. Goudy, Flushing, N. Y. App. filed April 19, 1928.

1,728,762. TRAFFIC SIGNAL; P. P. Horni, Newark, N. J. App. filed Dec. 9, 1926.

1,728,785. THERMAL RELAY; E. M. Claytor, Forest Hills Borough, Pa. App. filed May 14, 1927.

1,728,786. TERMINAL; O. A. Colby, Irwin, Pa. App. filed May 15, 1926.

1,728,790. CONTROL SYSTEM; W. F. Eames, Wilkinsburg, Pa. App. filed May 14, 1927.

1,728,791. ELECTRIC IRON; F. F. Forshee and F. Thornton, Mansfield, O. App. filed Dec. 29, 1925.

1,728,792. RANGE-BASE CABINET; F. F. Forshee, Mansfield, O. App. filed July 14, 1927.

1,728,793. THERMAL RELAY; H. S. Gano, Pittsburgh, Pa. App. filed Nov. 14, 1925.

1,728,794. CIRCUIT BREAKER FOR SNAP SWITCHES; F. P. Gates, West Hartford, Conn. App. filed July 26, 1927.

1,728,803. TEMPERATURE-INDICATING DEVICE; D. M. Palmer, Toledo, O. App. filed July 27, 1927.

1,728,810. ADJUSTABLE RESISTOR UNIT FOR THERMOCOUPLE CIRCUITS; F. S. Stickney, Pittsburgh, Pa. App. filed Aug. 11, 1927.

1,728,811. THERMOSTATIC SWITCH; I. G. Thomas, Mansfield, O. App. filed Aug. 6, 1927.

1,728,812. APPARATUS FOR LINE WELDING; H. W. Tobey, Pittsfield, Mass. App. filed Aug. 10, 1923.

1,728,813. APPARATUS FOR RENEWING FILAMENTS IN INCANDESCENT LAMPS; C. Tourne, Paris, France. App. filed June 8, 1927.

1,728,814. MANUFACTURE OF DUCTILE BODIES FROM HIGHLY REFRACTORY METALS; J. A. Van Liempt, Eindhoven, Netherlands. App. filed Jan. 16, 1925.

1,728,817. END SHIELD; A. P. Wood, Schenectady, N. Y. App. filed Jan. 6, 1928.

1,728,819. PANTOGRAPH CURRENT COLLECTOR; G. W. Bower, Schenectady, N. Y. App. filed Aug. 12, 1927.

1,728,820. TROLLEY-WIRE SUSPENSION; G. W. Bower, Wesleyville, Pa. App. filed Oct. 23, 1928.

1,728,829. ELECTRIC SWITCH; J. D. Hilliard, Schenectady, N. Y. App. filed April 30, 1925.

1,728,835. PHASE INDICATOR; H. S. Petch, London, England. App. filed May 1, 1928.

1,728,836. ELECTRIC SWITCH; C. F. Schwennker, Schenectady, N. Y. App. filed Sept. 29, 1927.

1,728,840. RELAY; H. Stavöstrand, Oslo, Norway. App. filed Aug. 17, 1927.

1,728,853. ELECTRICAL REGULATOR; F. A. Byles, Schenectady, N. Y. App. filed Jan. 7, 1928.

1,728,863. ELECTRIC-ARC WELDING; C. L. Ipsen, Schenectady, N. Y. App. filed March 23, 1927.

1,728,868. STORAGE-BATTERY CONNECTER; A. Pierce, San Antonio, Tex. Aug. 23, 1926.

1,728,885. ELECTRIC CHEMICAL VAPORIZER; E. M. Zurbrigg, Toronto, Ont., Can. App. filed Nov. 9, 1925.

1,728,911. ELECTRICAL CONNECTER; P. F. Williams, Chicago, Ill. App. filed June 17, 1922.

(Issued September 24, 1929)

1,728,952. CONDUCTOR TERMINAL FOR BUSHINGS; A. O. Austin, Barberton, O. App. filed July 29, 1922.

1,728,980. INCUBATOR; J. L. Robbins, Edgewater, Colo. App. filed Feb. 6, 1928.

1,728,983. ELECTRIC CONTROL; H. L. Sampson, Los Angeles, Calif. App. filed Jan. 10, 1927.

1,728,989. APPARATUS FOR THE ELECTROLYTIC PRODUCTION OF METALLIC POWDERS; M. A. Adam, London, England. App. filed Dec. 31, 1925.

1,728,997. VEHICLE ROUTE-DIRECTORY DEVICE; E. M. Johnson, Highland Park, Mich. App. filed April 16, 1927.

1,729,053. ELECTRICAL PROTECTIVE DEVICE; L. H. Rovere, Richmond, N. Y. App. filed May 19, 1925.

1,729,059. ELECTRODE HOLDER; A. E. Bicsey, McKeesport, Pa. App. filed Dec. 2, 1927.

1,729,071. WARNING SIGNAL FOR AUTOMOBILES; R. H. Gilbert, New York, N. Y. App. filed March 31, 1926.

1,729,080. SIGNAL-LAMP MOUNTING; B. F. Miessner, South Orange, N. J. App. filed Aug. 21, 1925.

1,729,091. TRANSFORMER SYSTEM; A. L. Atherton, Pittsburgh, Pa. App. filed May 11, 1921.

1,729,099. PROTECTIVE SYSTEM FOR TRANSFORMERS; W. R. Farley, Wilkinsburg, Pa. App. filed March 2, 1927.

1,729,109. BATTERY-CHARGING BENCH; B. J. Haskins, Chicago, Ill. App. filed March 15, 1928.

1,729,136. AUTOMATIC CONTROL APPARATUS; I. B. Smith, Ambler, Pa. App. filed June 24, 1925.

1,729,137. ELECTRIC ALARM SYSTEM; F. J. Stalmach, Houston, Tex. App. filed March 19, 1928.

1,729,145. PANEL BOARD; G. W. Berthold, Chicago, Ill. App. filed June 1, 1925.

1,729,160. RUBBER-COATED CONDUCTOR AND METHOD OF MAKING SAME; E. W. Engle, Lake Forest, Ill. App. filed Feb. 23, 1926.

1,729,161. SOUND RECEIVER AND TRANSMITTER; I. C. Clement, Wakefield, Mass. App. filed March 22, 1927.

1,729,183. ELECTRIC SADIRON; M. H. Perez, San Pedro Sula, Cortez, Honduras. App. filed Sept. 29, 1926.

1,729,222. ALTERNATING-CURRENT RELAY; A. F. Lake, Oakland, Calif. App. filed April 6, 1926.

1,729,238. MOBILE THERAPEUTIC LAMP UNIT; F. A. Anderson and R. H. Maxson, Milton, Wis. App. filed Oct. 11, 1926.

1,729,239. THERAPEUTIC LAMP; F. A. Anderson, Milton, Wis. App. filed Jan. 6, 1928.

1,729,263. ELECTRIC-ARC-LAMP CATHODE WITH ROTARY FLAME AND STATIONARY CRATER; R. Dubois, Toulon, France. App. filed May 14, 1925.

1,729,270. ELECTRICAL HEATER FOR ENGINE-JACKET SYSTEMS; H. W. Jelliffe, Cleveland, O. App. filed March 16, 1927.

1,729,281. ELECTRIC HORN; W. B. Connolly, Rochester, N. Y. App. filed March 30, 1925.

1,729,284. ELECTROMAGNETIC HORN; F. F. Dorsey, Rochester, N. Y. App. filed July 16, 1926.

1,729,315. ELECTRICAL-CONDUIT CONSTRUCTION; B. O. Widell, West Hartford, Conn. App. filed Oct. 17, 1928.

1,729,320. INSTRUMENT FOR MEASURING ELECTRIC CURRENTS; A. N. Anderson, Crafton, Pa. App. filed Sept. 2, 1927.

1,729,326. CURRENT RECTIFIER; J. F. Cavanagh, Providence, R. I. App. filed Aug. 11, 1927.

1,729,337. SIGNAL LIGHT AND METHOD OF MAKING SAME; G. W. Frost, Milwaukee, Wis. App. filed July 19, 1926.

1,729,343. DYNAMO BRUSH; N. R. Haas, Dayton, O. App. filed Dec. 1, 1924.

1,729,345. REPULSION INDUCTION MOTOR; F. Kade, Kiel, Germany. App. filed March 26, 1924.

New Trade Literature

SAG METER.—American Askania Corporation, Houston, Tex., has issued a bulletin describing the Küppers sag meter. This eight-page booklet opens with a discussion of the purpose of the instrument, its design and methods of using the equipment.

RECORDING INSTRUMENTS.—Bulletin number 829 has been issued by the Esterline-Angus Company, Indianapolis, descriptive of graphic instruments for the control of important processes. The bulletin cites a few examples of the successful application of these instruments to industrial processes.

AUTOMATIC COMBUSTION CONTROL.—Bailey Meter Company, Cleveland, Ohio, has issued bulletin No. 181 descriptive of Bailey automatic control. This bulletin contains detailed descriptions of the outstanding features of this automatic combustion control.

ASBESTOS PROTECTION.—A bulletin that deals with the process of insulating motors with asbestos, replacing materials commonly used for insulation, has just been released by the U. S. Electrical Manufacturing Company of Los Angeles. The interesting process of applying asbestosite is thoroughly described.

GEAR DRIVE.—Bulletin 91C on the new red giant silent chain-spur gear drive "model M" has been published by the Revolvator Company, manufacturer of material-handling equipment with headquarters in Jersey City. It is the purpose of this bulletin (pages 9 to 12) to feature and describe the silent chain motor driven type of hoist, model M, which can be installed on any type of base, hinged or telescope frame, or with any style of platform. The combinations of frames, bases, hoists and platforms are discussed and illustrated on other pages.

AIRPORT LIGHTING.—A new publication has just been released by the Westinghouse Electric & Manufacturing Company on airport lighting. This booklet, No. S. P. 1854, shows the part Westinghouse is playing in the advancement of aviation by furnishing adequate lighting equipment for the night illumination of airports. Contained in the publication are the lighting requirements of the U. S. Department of Commerce, including the candlepower for beacons, wattage for boundary lights, obstruction light requirements, and the location and intensity of illumination of floodlights and ceiling projectors. The Westinghouse general plan for airport illumination is given with diagram to illustrate, together with a description of the lighting installation at the Newark metropolitan airport and detailed descriptions of Westinghouse "Chromilite" floodlights, marker and hangar lights. The whole booklet is profusely illustrated with installation photographs showing day and night views of lighted airports and diagrams of the layout of landing fields.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is sought in Liverpool, England (No. 41,034), for low-priced electrical refrigerators.

Agency and purchase are sought in Prague, Czechoslavakia (No. 41,134), for sterilizing apparatus for hospitals and physicians.

An agency is sought in Vancouver, B. C. (No. 41,026), for electric toasters.

Purchasers are desired in Karathi, India (No. 41,091), for electrical toys.

Agency is desired in Athens, Greece (No. 41,022), for vacuum cleaners and other apparatus for cleaning railway cars.

Either purchase or an agency is sought in Copenhagen, Denmark (No. 41,029), for enameled electric wire.

An agency is sought in Sao Paulo, Brazil (No. 41,028), for flexible and rigid conduits and high-tension porcelain fittings.